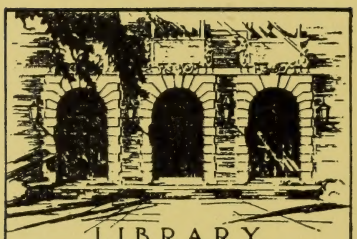

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South Dakota State School of Mines

Annual Catalog 1916-1917

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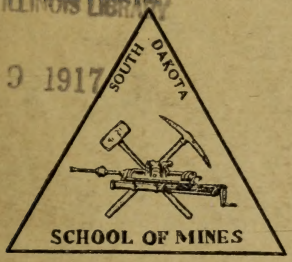

With Announcements
For 1917-1918

Rapid City, South Dakota

May, 1917

South Dakota State School of Mines

Annual Catalog 1916-1917

With Announcements
For 1917-1918

Rapid City, South Dakota

May, 1917

• 1917 •

JANUARY.

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College Calendar

1917

Sept. 17, 18, Monday and Tuesday ..... Registration.
Sept. 19, Wednesday .... First Semester begins.
Nov. 29, Thursday ..... Thanksgiving Recess begins.
Dec. 24, Monday ..... Christmas Vacation begins.
Jan. 5, Saturday ..... Christmas Vacation ends.
Jan. 28 to Feb 2 ..... Midyear Examinations begin.

1918

Feb. 2, Saturday ..... First Semester ends .
Feb. 4, Monday ..... Second Semester begins.
Feb. 22, Friday ..... Washington's Birthday.
April 1 to 6 ..... Annual Field Trips.
May 26, Sunday ..... Baccalaureate Sermon.
May 27, Monday ..... Final Examinations begin.
May 29, Wednesday ..... Commencement and Conferring of Degrees.
May 30, Thursday ..... Memorial Day.
June 1, Friday ..... Final Examinations end.

Regents of Education

Members of the Board

THEODORE W. DWIGHT, Sioux Falls,
Term expires January 1, 1921

THOMAS D. POTWIN, Lemmon,
Term expires January 1, 1923

AUGUST FRIEBERG, Beresford,
Term expires January 1, 1919

FRANK ANDERSON, Webster,
Term expires January 1, 1919.

J. W. CAMPBELL, Huron,
Term expires January 1, 1921.

Officers of the Board

THEODORE W. DWIGHT, President, Sioux Falls
IRWIN D. ALDRICH, Secretary, Big Stone City
A. W. EWERT, (State Treasurer), Treasurer Ex Officio

Regents Committee in Charge of the School of Mines.

THOMAS D. POTWIN FRANK ANDERSON

FACULTY OF THE SCHOOL OF MINES

CLEOPHAS CISNEY O'HARRA
President and Professor of Geology
A. B., Carthage College; Ph. D., Johns Hopkins University.

HOWARD LINCOLN McLAURY
Professor of Mathematics
A. B., Oberlin College; A. M., Harvard University

JOSEPH HERBERT STEELE*
Professor of Engineering
B. S., C. E., Michigan Agricultural College

JOHN McLEARIE
Professor of English
A. B., Macalester College; A. M., University of Chicago

WELTON JOSEPH CROOK†
Professor of Metallurgy
Melbourne School of Mines; A. B., Leland Stanford University

JOSEPH JAMES RUNNER
Professor of Mineralogy and Petrography
A. B., University of Nebraska

MINER LOUIS HARTMANN
Professor of Chemistry
B. S., University of Arizona; Ph. D., Harvard University

CHARLES LEE SWISHER
Professor of Physics.
A. B., University of Illinois; A. M., University of Michigan

WILLIAM CHARLES BOCHERT
Professor of Mining
B. S., South Dakota State School of Mines

*Died March 12, 1917.
†Resigned March 31, 1917.

ANNUAL CATALOG

CLARENCE LESLIE LEWIS
Lecturer on Mining Law
University of Michigan

HUGH W. TALBOT
Instructor in Preparatory Science and Mathematics
B. S., Colgate University

BERTHA THOMAE
Instructor in Modern Languages and History.
B. A., Mississippi State College.

WILLIAM A. COURSEN
Superintendent of Buildings and Grounds and Instructor in Machine Shop

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DELLA MAY HAFT
Librarian
Ph. B., University of Chicago

ANNA LEWIS
Registrar and Secretary to the President.

Student Assistants.

EDWIN CLARK, Physics.
GEORGE ENOS, Chemistry.
VIRGIL PRICE, Chemistry.
WILLIAM A. WALDSCHMIDT, Museum.

Other Employees.

MRS. A. O. ANDERSON, Janitor.
FRANK BOYD, Fireman.

Standing Committees of the Faculty

ADMISSION AND REGISTRATION

Joseph H. Steele — Joseph J. Runner
John McLearie

EMERGENCIES

Howard L. McLaury — John McLearie
Miner L. Hartmann — William C. Bochert
Joseph J. Runner — Charles L. Swisher

STUDENT WELFARE

William C. Bochert — Howard L. McLaury
Bertha Thomae — Joseph H. Steele
Charles L. Swisher

THESES AND DEGREES

Welton J. Crook — Joseph J. Runner
Miner L. Hartmann — William C. Bochert

ATHLETICS

William C. Bochert — Howard L. McLaury
John McLearie

SCHOOL MAGAZINE

John McLearie — Miner L. Hartmann
Joseph H. Steele — William C. Bochert
Bertha Thomae

CATALOG

Joseph H. Steele — Charles L. Swisher
Hugh Talbot

LIBRARY

Hugh Talbot — Welton J. Crook
Della M. Haft — Joseph H. Steele

BOARD OF CONTROL OF THE ATHLETIC ASSOCIATION

John McLearie	Luther M. White '18, Sec.
Cleophas C. O'Harra	Frank Cremer '17.
William C. Bochert	Sidney Wilson '19.

Dr. Charles McDowell

Howard L. McLaury, Secretary of the Faculty

The regular meeting of the Faculty is held on the first Friday of each month at 3:45 P. M.

General Statement

Establishment of the School

The School of Mines is a state educational institution, and is at the present almost wholly maintained by appropriations of the State Legislature. It is endowed with 40,000 acres of South Dakota land, a grant from the federal government. It receives a comparatively small income from the rental of these lands, which are, however, steadily increasing in value. The school is under the Regents of Education. The regents, five in number, are appointed by the governor, confirmed by the senate and have control of the various public institutions of learning maintained wholly, or in part by the state as state institutions.

The following is an extract from the act of the Legislature, establishing the School of Mines:

Section 1. (School of Mines Established.) That a School of Mines for the Territory of Dakota be established at Rapid City, in Pennington County, Dakota Territory. It shall be the object of such School of Mines to furnish facilities for the education of such persons as may desire special instruction in Chemistry, Metallurgy, Mineralogy, Geology, Mining, Milling, Engineering, Mathematics, Mechanics, Drawing, the Fundamental Laws of the United States and the Rights and Duties of Citizens.

Approved March 7, 1885.

History and Aim of the School

The chief aim of the State School of Mines is to offer young men a thorough education in mining and metallurgical engineering, believing that thereby the exploitation of the mineral resources of the state will be aided. Whenever it is possible, the school also aids the development of the mineral resources of the state by the investigation of mining and metallurgical

problems which arise. At the present time many graduates of the School are employed in responsible positions in the Black Hills and throughout the West generally, and are doing much toward the development of the state's mineral wealth. It is well known that the successful exploitation of the Cambrian ores of the Black Hills has been due in a large measure to the experiments performed at the State School of Mines. This refers particularly to chlorination, to sulphide smelting and to cyanidation.

Recent demonstration of the possibilities of artesian wells in the western part of the state has been largely due to the work of this school, together with that of the United States Geological Survey.

The School issues from time to time, bulletins treating of Black Hills geology, and of mining and metallurgical methods. These may be obtained by those interested upon request.

The first building of the School was erected in 1885. It is a three-story brick structure costing approximately $12,000, in which were originally, chemical and assay laboratories, and class rooms. The staff of instructors was necessarily small and the course by no means complete. The school however, under able management, gained in reputation, and, in 1887, erected a second building to serve the purpose of a metallurgical laboratory. This building, costing nearly $30,000, is 138 feet by 60 feet in size, and was fitted with metallurgical and mining experimental machinery. In 1901, the front portion of what is now the Main Building of the school was erected, the legislature appropriating $20,000 for that purpose. In 1903 $18,000 was appropriated by the legislature for a rear addition and $5,000 was appropriated for the construction of a separate heating plant. In 1905, $8,000 was appropriated for the improvement of the metallurgical laboratory, and extension of the heating plant; in 1907, $15,000 for additions to the metallurgical laboratory, and in 1909, $8,000 for further extension of heating plant and improvements to the metallurgical laboratory.

In 1911 the legislature appropriated $5,000 for repairs to the Preparatory Building, $2,500 for re-

placements in the heating plant, $2,000 for an electric generator and $800 for new cement sidewalks.

The number of buildings and equipment at the present time is such as to give good facilities for thorough instruction in mining and metallurgy and allied subjects.

Location

The School of Mines is located at Rapid City in the foothills of the Black Hills of South Dakota. The Black Hills region is the gem of the central northwest. Perhaps no area of equal extent in America more fittingly represents a well-selected group of community interests. By geographic position, topographic configuration, natural resources and commercial facilities it is the controlling magnet of a great area for industry, trade and recreation.

Structurally the region is an elliptical outwardly-dipping uplift, the more distinct features of which show a maxmium extent of about 150 miles in length and 80 miles in width. The longer axis approximately coincides with the meridian except in the northern portion, where the general direction is to the northwest. Each rock unit with its particular and sometimes striking color yields distinctive topographic forms, the result being that in many places features of rare interest are produced. The Harney Peak area of the southern Hills with its bold pinnacles and shoulders of coarse, bare granite rising from their forest-clad base of metamorphosed sedimentary rocks, presents a beautiful landscape, while the steep-walled canons of Spearfish creek, Rapid creek and Elk creek in the Northern Hills are among the most picturesque that America can show. Again to the northwest along the upper Belle Fourche valley, where the nearly horizontal sandstones and shales have been intricately carved by the various streams and where the brilliant and varied colors of the several formations harmoniously blend with a wealth of forest and pasture overlooked here and there by the stately somber forms of porphyry buttes, there is presented a view well worth many hardships to see.

The climatic conditions of the Black Hills proper are scarcely excelled anywhere in the United States. The rainfall is not heavy, but is generally sufficient and the chief precipitation comes during the planting and growing season when most needed. Aside from this, clear, mild days prevail through much of the year. Extreme cold and extreme heat are exceptional and of short duration.

The mining interest of the Hills are of paramount importance, but large industries, particularly forestry, agriculture, horticulture, stock-raising and manufacturing share in the fundamental occupations of the people. The mineral products are gold, silver, lead, copper, iron, tin, tungsten, mica, spodumene, amblygonite, fullers earth, volcanic ash, and structural materials, including clay, cement ingredients, and building stones. The total mineral production since the first mining in 1875 is approximately $235,000,000.

In addition to the natural features of the region, the political, social, educational and moral status of the people is commendable to a marked degree. Few new countries show a greater percentage of cultured men and women interested in the healthy advancement of a whole region and in the all-round development of every individual. Communication with all parts of the Hills is facilitated by excellent wagon roads, and railroads are convenient to every important district. The main lines connecting with other parts of the country are the Chicago and Northewestern railway, the Chicago, Burlington and Quincy railway, and the Chicago, Milwaukee and St. Paul railway. Rapid City is on the line of the Chicago and Northwestern connecting with Omaha, also on the line of the same road connecting with the eastern part of the state, through Pierre, and on the Chicago, Milwaukee and St. Paul conecting with the eastern part of the state through Chamberlain. It has also connection with the Burlington system by means of the Rapid City Black Hills and Western railway from Rapid City to Mystic.

Rapid City is a growing city of about 5,000 inhabitants. It was founded in 1876 and is the most

beautifully located city in the Black Hills. It is situated on Rapid creek 3200 feet above sea level, and a half hour's walk takes one either out on the plains or into the hills. It offers many advantages as a college and residence city. There are seven churches, a hospital, a fine new opera house, four banks, a United States land office and weather bureau, wholesale and retail mercantile establishments, various manufacturing enterprises, many rooming houses, good hotels and enterprising newspapers. The city has also an excellent system of water works fed by springs four miles back in the hills; a modern illuminating gas works, a sewer system, and a hydro-electric plant furnishing light and power.

The people of Rapid City are interested in the welfare of the school and in addition to the usual social advantages of the place, opportunity is not infrequently given the students living elsewhere to enjoy the pleasures and influences of the best homes of the city. An additional feature of interest is that all students room and board in the homes as the school does not maintain a dormitory.

The distance to the chief gold mining districts of the northern Hills near Deadwood and Lead is less than fifty miles. The mining districts of the central Hills west and southwest of Rapid City are still nearer. This gives the student convenient access to active mining operations whenever desired and at the same time prevents undue distraction liable to result were the school in the midst of the hurry and hustle of mines and mills.

A particularly helpful feature, the value of which cannot well be overestimated, is the opportunity the students have for working in the many mines and mills of the Hills during the summer vacations. This work following the year's schooling not only surpasses the ordinary summer mining course in the gaining of practical information, but, to the energetic student, is also a source of ready cash.

Electrical Engineering and Civil Engineering Courses.

The School of Mines has from the early days of its organization maintained classes in various

branches of Civil Engineering and for a considerable number of years it has done the same in Electrical Engineering. The laboratory and field equipment necessary for the giving of proper instruction in these engineering studies has grown in proportion to the needs of the institution and now serves to give extended courses in these subjects. The Regents of Education have authorized the school to outline its course of study to the effect that students taking work to receive degrees already in vogue, should have the option of majoring in either Electrical or Civil Engineering. In conformity with this authorization a four years course in Electrical Engineering and a four years course in Civil Engineering have been outlined and these courses are now offered. In the purchase of apparatus for teaching these engineering courses efficiency has been the guiding feature and the apparatus is the best obtainable.

The varied development in the Black Hills region during the past several years has added emphasis to this work and to the urgent need for strengthening these courses. In civil engineering there is road making, bridge building, railroad construction, mine surveying, irrigation work and the various phases of mining and municipal problems. In electrical engineering there are particularly the hydro electric and the steam electric plants for the generating of light and power for mines and metallurgical plants, manufactories and municipalities. Four hydro electric plants on as many different mountain streams of the Black Hills and costing approximately two million dollars serve to indicate the present trend of activity and to indicate the latent possibilities of our swifter streams. Several thermo electric plants are also in operation.

Buildings and Grounds

The buildings in which the work of the School is carried on are four in number: First the original School of Mines building, a commodious brick structure, three stories in height, situated in the west part of the grounds, and at the present time devoted entirely to the Preparatory Department, in which stu-

dents found deficient in studies for entrance into the School of Mines are properly prepared. It contains a large assembly or study room and class rooms for the study of languages, mathematics, and history, a laboratory for biology, and a new and well equipped woodshop. It is heated throughout by steam from the central power plant and is lighted by electricity. This building has recently been extensively repaired and remodeled throughout and is now modern and well adapted to its purpose.

In the center of the grounds is the Main Building of the school, a large, brick structure, with native sandstone trimmings, three stories in height, built in two wings. This building contains, in the front wing on the first floor, a large entrance hall, the President's and Registrar's offices, lecture rooms for Mathematics and English, and the Geological Museum; also, in the rear, the Library and the Department of Geology and Mineralogy, consisting of lecture room, office, map and mineralogical store rooms, and a thoroughly equipped mineralogical laboratory. On the second floor are the Department of Chemistry and the Department of Engineering. The chemical laboratories comprize the general, qualitative, and quantitative laboratories, with balance room, supply rooms, lecture room and office, together with a private laboratory for the professor in charge. The Department of Civil Enginering consists of instructor's office, two large drawing rooms, a lecture room, supply rooms and a room equipped for making blue prints. In the basement are the physical laboratory, store rooms, a locker room, lavatories, a special experimental room, an engine room with a gasoline engine, and a machine shop. The machine shop enables the School to make a very appreciable amount of apparatus for scientific work as the occasion for its construction arises.

East of the Main Building is the Metallurgical Laboratory Building, 138 feet by 60 feet in plan, two stories high, built of red brick covered with stucco. This building is devoted exclusively to the Departments of Mining and Metallurgy. It contains, on the first floor, a large laboratory for ad-

vanced metallurgical chemistry, a well equipped balance room, containing massive concrete piers for the mounting of balances, private chemical laboratory and supply room, assay laboratory and a large assay furnace room. In the rear of the assay furnace room is the metallurgical laboratory containing mining and metallurgical machinery and apparatus and storage bins for ore and fuel. On the second floor are the lecture rooms of the Departments of Mining and Metallurgy, offices of these departments, and the mining and metallurgical museum.

On the east part of the school grounds is located the central heating plant, containing an aggregate of 250 horse-power of boilers which supply heat for the three large buildings mentioned above, and power for the metallurgical and other laboratories by means of two 35 K. W. steam turbines connected to direct current generators. A third turbine unit similar to the above, but of seven K. W. is available for experimental work, and a three-panel switch board supplies connections. This building is built of stone and has adjoining sheds with a large capacity for the storage of coal. There is also in the boiler house a blacksmith shop for instruction in forge work.

Equipment

In general, the school is well equipped to carry on its work. It has the essential of modern scientific technical instruction, ample laboratory facilities in all required branches.

Library

The library and reading room occupies a large, well lighted and well equipped room on the first floor of the Main building. Here are found the standard works on Metallurgy, Mining, Geology, Chemistry, Engineering, Physics, Biology, Mathematics, English, History, Economics, and many works of a general nature.

Authoritative scientific journals published in the United States, Canada, Mexico, England and Germany are found on the reading tables and are bound when volumes are completed—putting in substantial

SCHOOL OF MINES ORCHESTRA

form the latest research in the sciences taught in this school.

The learned societies of the United States and England are represented by the publications of the Royal Society of London, of the Institution of Mining and Metallurgy, of the Institution of Mining Engineers, of the Iron and Steel Institute and of the American Institute of Mining Engineers, of the American Chemical Society, of the Society of Chemical Industries and of the American Institute of Electrical Engineers.

The library is the repository of the documents of the United States Geological Survey, many of the state geological surveys and surveys of some of the foreign countries.

The Dewey system of classification is used and a card index gives author, title and subject.

The privileges of the Library are extended to those not attending the college who may find use for its books of reference.

Drawing Rooms

In the Department of Engineering are two large drawing rooms—one for Freshman work, the other for Sophomore and Junior work.

The rooms are well lighted and fitted with especially designed drawing desks, each desk containing lockers in which students take care of their supplies. Adjoining the Freshman drawing room is a large room for the making of blue prints. It contains the blue print machine, sliding on a frame in the window, with south exposure so that sunlight is available for the greater part of the day. Sinks for washing blue, brown and black prints are provided.

Chemical Laboratories

There are four chemical laboratories in the Main Building—one for general chemistry, one for qualitative analysis, one for quantitative analysis and a special laboratory for fuel and water analysis. The quantitative and qualitative laboratories are equipped with large individual desks with tile tops, each desk being supplied with gas from the city mains. Be-

tween the desks are sinks with flowing water. The laboratories are also supplied with compressed air and with apparatus for suction. Each student receives a separate and complete set of reagent bottles and supplies. The laboratories are well lighted and provided with ample hoods to carry off the fumes. The quantitative laboratory is equipped with a separate weighing room in which are analytical balances of standard makes. In addition to these laboratories there is a private laboratory for the professor of chemistry, a special dark room for spectroscopy, a dark room to be fitted for photochemistry, and two supply rooms from which the students get their apparatus and chemicals as needed.

The laboratories have recently been overhauled and the woodwork and desks refinished. The hoods have also been rearranged in order to get better ventilation and new ones have been installed.

The apparatus is ample for all mineral, alloy and rock analysis, as well as for research along certain lines. The special apparatus includes combustion furnaces, apparatus for gas analysis, facilities for electro-chemistry, colorimeters for fuel analysis, spectroscopes for qualitative experiments, and electroscopes for determination of radium and uranium in waters, gases, and minerals.

Biological Laboratory

The equipment in this laboratory is modern and suitable for bacteriological, zoological and botanical purposes. A large Alberene stone aquarium containing aquatic plants and animals is maintained to show their interrelations and habits of growth and reproduction. We have excellent charts and slides which greatly aid in the study of living material. Compound and dissection microscopes are used throughout the work. Our large herbarium and a collection of representative animal forms are used to great advantage in obtaining interest and proficiency.

Physical Laboratory

The Physical Laboratory is located in the basement of the Main Building. It has a cement floor

and the tables are on cement-pillars, thus securing stable foundations for such apparatus and instruments as require them. The laboratory is well equipped for accurate experimental work. Among the more important pieces of apparatus are precision balances, reciprocating and mercury air pumps, acceleration apparatus and Atwood machine; a variety of apparatus for specific gravity, including hydrometers, Jolly balances, Westphal balances, etc., large Steinheil spectroscope, large vernier spectrometer, precision apparatus for complete measurements in interference, diffraction, polarization and dispersion of light; apparatus for sound measurements; complete equipment for calorimetric determinations of specific heat by the method of mixtures, Waterman's method, Bunsen's method, or the cooling method, Mahler-bomb calorimeter for heat of combustion, latent heat of vaporization, etc., Dalton's apparatus, complete apparatus for the determination of the mechanical equivalent of heat, Regnault's apparatus; seconds clock with electrical attachment; barometers, precision thermometers and pyrometers, air thermometer, Beckman thermometers; and a complete line of instruments for electrical measurements, including Weston voltmeters, ammeters and wattmeters for a variety of ranges, Weston and Paul alternating current voltmeters and ammeters, Leeds and Northrup potentiometer, Leeds and Northrup precision wheatstone bridge, Kohlrausch bridge, standard condensers, Siemens electrodynamometers, Braun hot wire meters, Nalder Bros. standard inductance, Weston, Leeds & Northrup, and Cambridge Scientific Instrument Co.'s galvanometers, Braun electrometers, Dolezalek quadrant electrometer, aluminum and gold leaf electrometers and electroscopes, magnetometers, voltameters, fluxmeters, permeameters, Waulff precision resistances; also completely equipped switch-boards for both high and low voltage distribution of direct or one, two or three phase alternating current, made by Max Kohl of Germany, and many special pieces of electrical apparatus, as Tesla transformers, induction coils, X-Ray apparatus, spark and arc spectrum apparatus; a variety of

dynamos, motors, motor-generator set, induction machines, gasoline engines, and models of steam and gas engines.

The School also possesses a completely equipped wireless telegraph station consisting of a sending set of one KW capacity and sensitive receiving sets for long distance messages. Among the larger pieces of apparatus is a Westinghouse 10 K. W. rotary converter designed for many different kinds of experimental work and embodying in itself the features of a number of different electrical dynamo machines. It is designed to be operated upon either alternating or direct current and will act as a generator or as a motor. When using alternating current its operation may be one, two, or three phase. Complete switchboard equipment is provided for its control in any one of its many modes of operation and includes a complete set of high grade measuring instruments for both alternating and direct current measurements. These include ammeters, voltmeters, wattmeters, power factor meters, frequency meters and dial synchroscope, all mounted on white marble panels which also carry the A. C. and D. C. circuit breakers, switches, plugs, etc. These switchboards also control a General Electric Company's 15 H. P. three phase induction motor with phase wound rotor and drum control for variable speed service. This machine may be connected to the rotary converter above described by a link belt silent chain for full load tests on either machine. The equipment also includes a one K. W. motor generator set consisting of a single phase induction motor and a shunt wound generator. There are also a number of smaller A. C. and D. C. motors of various types. In addition to the above, the School heating and lighting plant and the equipment of the Department of Mining and Metallurgy afford the student opportunity for making tests on dynamos and motors, engines and turbines of commercial sizes. The laboratory is well equipped with tools and work benches for the construction of special pieces of apparatus.

Apparatus for Civil Engineering

The School of Mines is well equipped with surveying instruments for all kinds of plane surveying. It possesses one Gurley Y level, one Dietzgen Y level, one Berger Dumpy level, one Bausch and Lomb precision level, two Gurley transits, one with solar attachment, one Keuffel and Esser transit with Saegmuller solar attachment, one Dietzgen transit with auxiliary mining telescope, one Ainsworth transit with auxiliary mining telescope, one Bausch and Lomb mining transit, one Keuffel and Esser plane table, one Keuffel and Esser sextant, one clinometer, one planimeter, together with complete equipments of stadia rods, levelling rods, range poles, field glasses, tapes, chains, axes, etc. The topography of the lands near the school offers excellent opportunity for all kinds of field work, with every degree of difficulty from flat prairie to the most rugged of rough hill country.

A Riehle cement testing machine is available for testing cement briquettes.

Assay Laboratory

The assay laboratory is modern in its appointments. It contains a room in which the students are provided with individual desks, pulp balances for the mixing of assay charges; a balance room provided with concrete foundation piers; the pulp room in which the ore samples, etc., are crushed and sampled, and the furnace room in which furnace work is done exclusively. This furnace room contains two gasoline assay furnaces and five double muffle-furnaces, heated by soft coal. These are placed in openings in a heavy dividing wall, separating the machinery hall from the front part of the building. In this way the front of the furnaces with the muffle openings are in the furnace room, flush with the wall, while the firing and taking out of the ashes is done on the other side of the wall, thus avoiding the dust and dirt in the main work room. The furnace room is fireproof. There is a melting furnace using coke, and gasoline furnaces, made by Braun & Company, San Francisco. Large gas furnaces are available for ex-

perimental work, such as roasting, smelting, annealing, etc.

The balance room is provided with Ainsworth, Eimer & Amend, Thompson, and Keller balances. In the pulp room an electric motor furnishes power for the small Gates sample crusher and a sample grinder. A Calkins automatic cupel machine is used for making cupels. A large number of ore samples are kept on hand. Ores from all parts of this country are provided in great variety. The nearness of smelters and mills makes it comparatively easy to procure many types of furnace products, such as mattes, flue dust, fume, and umpire sample for close checking work.

Mining and Metallurgical Laboratories

There are two metallurgical laboratories in the Metallurgical Building; one in which are conducted metallurgical experiments as out lined in Metallurgy 11 and 13, and the other in which the various metallurgical processes are performed on a commercial scale.

The experimental laboratory is equipped with individual desks provided with gas and air; analytical and pulp balances, hot plates, and water sinks; a complete cyanide plant of ten pounds capacity, consisting of a Trojan ball mill, high pressure blower, a Pachuca agitator and filter press; a Braun cyanide plant, a Hendryx mechanical agitator; gas and electric furnaces, pyrometers, potentiometers and platinum resistance, pyrometer, Parr and Mahler-bomb calorimeters, electrical measuring instruments, etc.

The commercial laboratory is designed to illustrate chiefly the metallurgy of gold, silver, copper and lead, and is best adapated to handle ore in quantities of from three to five tons, though as much as 75 tons may be passed through the furnace units.

The crushing machinery consists of a No. O Gates breaker, a pair of 16x10 in. rigid rolls, a 6x4 in. Bosworth jaw crusher, a 10x4 ft. Alsing tube mill, a 3 1-2 ft. Huntington mill and a 3-300 lb. stamp battery and amalgamating plates.

The cyanide plant consists of two 5x3 ft. sand tanks, two 5x5 ft. slime tanks; two 4x3 1-2 ft. solu-

tion storage tanks; two 4x3 1-2 ft. gold solution tanks and two zinc boxes. For the agitation of slime a 10x2 1-2 ft. Pachuca tank is used, while for slime thickening and filtration a 5 ft. Callow cone and small Moore vacuum filter are employed. The accessory apparatus for cyanidation consists of four 1 1-2 in. centrifugal pumps, a vacuum pump, an air compressor and receiver, and three electric motors for power, etc. The above plant is extremely flexible, so that any variation from an all-sand to an all-slime process can be demonstrated on a commercial scale.

The ore dressing apparatus consists of a Traylor table, a Frue Vanner, two classifying cones, an impact screen, a Vezin sampler, and a Jarvis experimental jig.

The present oil flotation apparatus consists of a complete Callow laboratory machine, a modified Hoover machine, and a slide machine. Important additions are contemplated for the coming year.

The smelting machinery consists of a 30 in. blast furnace which may be used for either lead or copper smelting, forehearths, slag cars, and other accessories; a small Bruckner roasting furnace, and a Green rotary blower. The crushing and cyaniding and concentrating machinery is so placed that any combination of apparatus desirable may be secured and practically every possible system of treatment worked out.

Metallographic Laboratory

This laboratory is equipped with six metallographic microscopes, microphotographic apparatus, polishing machines, etc., and much pyrometer apparatus, of various kinds, including potentiometer, resistance boxes, etc. Electric furnaces are provided for heat experiments and for metallography.

Mineralogical Laboratory

This is a large room well equipped with low tables arranged for study and determination of minerals. Students are provided with the necessary reagents and apparatus, by the department upon the

payment of a small fee. Each student has his own locker. A large working collection of carefully labeled minerals available for student's use is kept in specially designed cases ready of access, and a considerable collection of unknown minerals is at hand for determination.

Geological Museum

This museum is an important feature in the equipment of the School of Mines. Its contents have been chosen to assist in the teaching of geology, mineralogy, petrography and paleontology, rather than to become a storehouse of curiosities. The room has a floor area of thirty-six by forty-seven feet, is twelve feet high, and is lighted by ten large windows.

Two kinds of cases are used for the display of specimens—central cases and wall cases. There are eight central cases of oak, each consisting of two parts of three compartments each, with glazedtops, and a six compartment massive base; the whole constructed in such a manner as to serve practically as two sections, fitting tightly back to back. The display surface, under glass, is nearly fifty square feet for each case. The bases are especially designed for the storage of material not needed for constant exhibition.

The wall cases are finished in pine and have glazed doors. Each is seven feet six inches high and contains three double door compartments of six shelves. The cases are particularly adapted for the display of large specimens.

Cases one and two contain a general collection of minerals arranged according to Dana's system of classification. Cases three and four contain series of specimens to illustrate general features of mineralogy, geology and petrography. Case five contains a collection of well preserved fossils, carefully selected to show the more prominent features of paleontological interest. Case six contains representative collections of Black Hills ores and rocks. Case seven contains Cretaceous and Tertiary fossils from the Black Hills region, mainly from the Cheyenne river and the

White river Badlands. Case eight contains a good collection of Black Hills minerals.

The wall cases are for large specimens of all classes, some of which are very beautiful. The collection from the Black Hills is especially noteworthy and is very rich in rare minerals of the region, as for instance, lepidolite, wolframite, columbite, amblygonite, etc.

The museum contains two large topographic maps of the Black Hills made for the St. Louis exposition, also a very valuable and unique rock section of the Homestake mine, donated by the Homestake Mining Company of Lead, South Dakota. Many framed maps of mines and important geological regions adorn the walls and serve as an added educational feature of the room.

The collection of minerals exhibited by the school at the St. Louis Exposition, 1904, received a diploma and gold medal.

Mining and Metallurgical Museum

This is situated on the second floor of the Metallurgical Building, in a large, well lighted room and contains wall cases for the display of specimens. It has a fair collection of furnace products, such as slags, mattes, alloys, fuels, refractory materials, and wall boards and hoisting ropes and screens, safety lamps and models of head frames and similar materials. In time it will become a valuable adjunct to the teaching of mining and metallurgical subjects. It is constantly being added to by the kindness of manufacturers and mining companies, who donate exhibits. The school is always very grateful for donations of this kind and makes due acknowledgment for the same. New cases for the display of these things have recently been provided.

Shops

In the basement of the Main Building a small machine shop is provided containing a machine lathe, shaper, drill press, other machinery and many tools. Occasion often arises for repairs and for the design and construction of certain pieces of

apparatus for different departments, especially those of Metallurgy, Mining, Physics and Chemistry.

Many pieces of apparatus have been constructed in this shop which would have cost the school considerable sums of money. The students of the upper classes are granted permission to use the facilities afforded by the shop, whenever occasion arises to do so in their work.

A blacksmith shop, equipped with forges, anvils and tools, is located in the building containing the power and heating plant.

To provide manual training in the preparatory department, a wood shop has been installed in the Preparatory Building. This shop contains one motor-driven variable speed wood lathe, one 8-inch universal wood worker and complete sets of carpenter tools and benches.

Publications

The school publishes at irregular intervals bulletins of greater or less length on subjects covered by its various lines of activity. These may be obtained free of cost by persons interested so long as there are copies in stock. Eleven have been published. They are as follows:

Bulletin No. 1—Preliminary Report of the Dakota School of Mines upon the Geology, Mineral Resources and Mills of the Black Hills of Dakota; 171 pages. 1888. By F. R. Carpenter and H. O. Hofman. **(Out of Print).**

Bulletin No. 2—Notes on the Geology and Mineral Deposits of a Portion of the Southern Black Hills; 41 pages, 1899. By C. C. O'Harra and A. Forsyth.

Bulletin No. 3—Cyanide Experiments on the Silicious Ores of the Northern Black Hills, etc.; 27 pages. 1900. By A. Forsyth and G. H. Clevenger.

Bulletin No. 4—Two papers: A History of the Early Explorations, and of the Progress of Geological Investigation in the Black Hills Region; and A Bibliography of Contributions to the Geology and Geography of the Black Hills Region; 88 pages. 1900. By C. C. O'Harra. **(Out of Print).**

Bulletin No. 5—The Cyanide Process in the Black Hills of South Dakota; 88 pages. 1902. By C. H. Fulton. **(Out of Print.)**

Bulletin No. 6—The Mineral Wealth of the Black Hills; 88 pages. 1902. B. C. C. O'Harra. **(Out of Print).**

Bulletin No. 7—Metallurgical Practice in the Black Hills of South Dakota; 63 pages. 1904. By C. H. Fulton.

Bulletin No. 8—The Cement Resources of the Black Hills. 1908. By C. C. O'Harra, M. F. Coolbaugh, M. A. Ehle Jr. and C. H. Fulton.

Bulletin No. 9—The Badland Formations of the Black Hills Region; 152 pages. 1910. By C. C. O'Harra, **(Out of Print.)**

Bulletin No. 10—The Minerals of the Black Hills, 200 pages. 1914. By Victor Zeigler.

Bulletin No. 11—A Bibliography of the Geology and Mining interests of the Black Hills Region. 225 pages. 1917. By C. C. O'Harra.

The Pahasapa Quarterly

This is a magazine published by the students with the assistance and general supervision of the faculty. As the name indicates, it appears four times during the school year and is devoted to the interests of the School of Mines and of the Black Hills region, It contains articles of interest to engineers generally and to the students and alumni of the School of Mines especially. The subscription price is one dollar per year.

STUDENTS' EXPENSES

Tuition

The tuition and incidental fee is $6 per semester, or $12 per year, **payable in advance on registration.** This fee is the same to residents and non-residents of the state.

According to Section 209 of the Political Code, 1903, page 40:

"The regents shall fix all rates of tuition and other fees, to be paid by students, but such rates shall be the same in all the different institutions.

They may receive, in any one of the institutions under their control, free of tuition, two students, appointed by each State Senator and one by each Representative of the State Legislature, which appointees shall be residents of their respective districts or counties, and whose term shall expire with the term of office of said senator or representative, provided that such appointees shall comply wtih all the rules and requirements of the insttiution which they desire to enter. No student, however, shall receive any other gratuity whatever."

Fees and Deposits

The fees named below cover only the cost of materials and supplies necessarily consumed in the laboratory courses mentioned. All fees and deposits must be paid on registration at the beginning of each semester.

Chemistry 3-4, General Chemistry, per semester	$ 5.00
Chemistry 6-7, Qualitative Analysis, per semester	5.00
Chemistry 8, Quantitative Analysis, per semester	6.00
Chemistry 9 Metallurgical Analysis, per semester	6.00
Metallurgy 11-13, Metallurgical Laboratory, per semester	5.00
Metallurgy 15, Cyanide Testing, per semester	5.00
Metallurgy 2, Assaying, per semester	5.00
Students' Activities Fee, required of all regularly enrolled students, per semester	3.00
Fee for bachelor's degree	5.00
Fee for advanced degree	10.00
Fee for permit for "conditioned" examination	2.00

The deposits named below are made to cover the cost of breakage and extra supplies used in the courses named. The unused portion of each deposit will be returned to the student at the end of each semester.

Metallurgy 15, Cyanide Testing, deposit	$20.00
Metallurgy 2, Assaying, deposit	20.00

General breakage deposit for engineering students taking laboratory courses in Chemistry or Metallurgy 5.00

No platinum is furnished by the Department of Chemistry.

Other Expenses of the Nature of Fees

The Department of Engineering furnishes supplies for the mechanical drawing courses, practically at cost.

Engineering 1-2, Mechanical Drawing, will cost approximately $5.00 for the year, exclusive of drawing instruments, which the student purchases on his own account, prices ranging from $12.00 up for a good set of instruments.

Engineering 3-4, Descriptive Geometry, will cost approximately $2.00 for the year.

Engineering 7, Topographic Drawing and Engineering 9, Machine Design, will cost $2.00 for the year.

Living Expenses

Board and room may be obtained in town with private families or in boarding houses or hotels, at rates varying from $20 to $30 per month, according to accommodations; $25 per month is a fair average and will insure good board and room. Rooms only may be obtained for from $5 to $10 per month, and table board for from $5.00 upwards per week. This makes the expense for board and room for the school year of 35 weeks range from $160 to $275, according to location and accommodations.

Expense of laundry and incidentals vary with the individual. The average for laundry expenses is about $20 for the school year.

Approximate Cost of Text Books

Freshman year $13.00
Sophomore year 17.00
Junior year 20.00
Senior year 19.00

Total cost, including living, fees, books, incidental expenses, etc.

Freshman year	$280 to $380
Sophomore year	275 to 370
Junior year	320 to 430
Senior year	290 to 385

This estimate does not include expenses incurred outside of school. A certain sum for this purpose should be added according to individual taste.

Incidental Expenses

Students are required, at various times, to take part in the geological, mining and metallurgical trips undertaken into the Black Hills mining district. The geological trip of the Freshman year usually costs the student about $10. The surveying trip in the Sophomore year will cost about $12. Trips in the Junior and Senior year, for mining and metallurgical exploration, cost a similar sum; so that the student should figure on a cost of from $30 to $40 at least, for expenses of this kind during his four years' course at the school.

Opportunities for Self Help

Opportunity for self help in a town of the size of Rapid City is necessarily limited. It is also to be borne in mind that the course of study is an arduous one and requires the student's best effort, and if conscientiously and satisfactorily performed, will leave comparatively little outside time in which to earn money.

Some students find employment which nets them their board and lodging by doing chores in private families or assisting in some of the stores. Some find employment in the boarding houses. The school is able to assist a few students, to some extent, by employing them in the capacity of assistant janitors and similar work.

Students who have become acquainted, by a residence in town for a year or two, find it easier to obtain work than strangers. For this reason it is essential that a student who comes as a stranger to enter the school should be provided with sufficient funds to carry him through the first year, at the very least.

Athletic Association

The Athletic Association has for its aim the furtherance of legitimate athletics, and maintains football, baseball and basketball teams, and track athletics. It is governed by a Board of Control made up of three members of the faculty, three students selected from the Sophomore, Junior and Senior classes respectively, and one Alumni member. The association maintains baseball, football and tennis grounds. The school heartily encourages athletics within the proper limits. The Students' Activities Fee gives access to athletic grounds and pays for admission to games and for subscription to the Pahasapa Quarterly.

Conduct

The school has no codified rules of conduct. Students are held to a strict account of work and are expected to fulfill their inheritance as gentlemen. Failure to live up to the requirements is considered a sufficient cause for severing their connection with the school.

MINING EXPERIMENT STATION

The School of Mines aims to assist the prospector and mining man in every reasonable way in determining the nature and value of such rocks, minerals, and ores as he may have. For many years members of the institution have given a considerable part of their services to the determination of minerals and rocks and to the assaying and analyzing of samples sent in for determination. A large amount of experimental work has been done in order to learn the most economic methods of extracting values from ores. Recently the state has appropriated a special amount of money for the enlargement of this work and every effort will be made to make the service available to all people of South Dakota who may be interested. Assays for gold and silver are made for twenty-five cents per sample. Many qualitative analyses are made free and quantitive analyses are

made at as low rates as possible. Prices will be sent upon application. All samples for analysis or assay and letters accompanying the same may be addressed to the School of Mines Experiment Station.

REQUIREMENTS FOR ADMISSION

Freshman Class

Requirements for admission to the Freshman class are as follows.

Fifteen units are necessary for entrance.

Required Units

Algebra	1.5 units
Plane Geometry	1 unit
Solid Geometry	0.5 unit
English	3 units
History	1 unit
Physics or Chemistry	1 unit
Total required units	8 units

Elective Units

German	1, 2 or 3 units
French	1, 2 or 3 units
Latin	2, 3 or 4 units
Greek	1 unit
Spanish	1 or 2 units
English	1 or 2 units
History	1 or 2 units
Mathmetics	0.5 unit
Science	1 or 2 units
Drawing	1 unit
Shop Work	1 unit
Civil Government	0.5 unit
Bookkeeping	1 unit
Elective units required for entrance..	7 units

A unit course of study is defined as a course covering a school year of not less than 35 weeks with 5 periods of at least 45 minutes each per week.

Methods of Entering the School

Graduates of accredited High Schools in the State of South Dakota and other states will be provisionally admitted without examination, if they present proper credentials, certifying to the fact that they have completed the studies mentioned under the requirements for admission.

Other candidates for admission will be given credit for so many of the fifteen required units as they may bring credits for, and will be permitted to make up the remainder in the Preparatory Department of the School of Mines, which is maintained for the special purpose of preparing students found deficient in entrance requirements.

Credentials for entrance should be in the hands of the President on or before the date set in the calendar for the examination of credentials by the committee on admission.

Application for admission blanks will be sent upon request.

DESCRIPTION OF UNITS REQUIRED FOR ENTRANCE

Required Units

Mathematics: The three units which may be offered in mathematics are as follows:

Algebra—One and one-half units. The equivalent of A, B and C Algebra described under Prepreparatory Mathematics in the Preparatory Announcement.

Plane Geometry—One unit. The equivalent of plane geometry described under Preparatory Mathematics.

Sold Geometry—One-half unit. The equivalent of solid geometry described under Preparatory Mathematics.

English—Three units. The equivalent of English 1-2 and 3-4 described under Preparatory English and other courses described in that department.

Physics—One unit. The equivalent of physics described under Preparatory Physics in the Preparatory Announcement.

Chemistry—One unit. The equivalent of elementary chemistry described in the Preparatory Announcement.

History—One unit. The History of the United States, English, Ancient or Modren History as described under History in the Preparatory Announcement.

Elective Units

The equivalent of courses, not mentioned above, described under Mathematics, (Trigonometry only), Languages, History, English and Preparatory Science, in the Preparatory Announcement.

Special Students

Applicants for admission, who are graduates of colleges or technical schools will be admitted as special students and permitted to take any subject they desire, taught in connection with the regular courses. Persons of mature age, who have been employed in mines and metallurgical plants and who desire to take up special courses particularly along the lines of mining, metallurgy and geology, will be admitted as special students, provided they show that they have sufficient foundation to take up the work with profit to themselves. No immature person will be permitted to enter the school to take advanced courses, such as Assaying, Metallurgy, etc.

GENERAL STUDIES

The South Dakota School of Mines is frequently approached by students, both men and women, who have no ambition to become engineers but who seek to enlarge their mental horizon by taking some of the subjects of more general interest offered in the engineering and preparatory courses. To all such persons the School of Mines extends a cordial welcome and offers every facility at its disposal for their cultural benefit. The attention of persons so minded is called to the following list of subjects, all taken

from the regular courses, which have a general educational value: English literature, foreign languages—including French, German and Spanish,—history, sociology, economics, mathematics, biology, geology, mineralogy, chemistry, physics, astronomy, drawing. From these subjects a course may easily be selected corresponding to the first two years of a general college curriculum. Every effort will be made to give satisfactory attention to special students taking work along any of these lines. The only fees charged are the usual tuition and students' activities fees and such laboratory fees as may be required in courses taken.

Short Course

A Short Course, of six weeks duration, is offered each year, beginning with the assembling of school after the Christmas vacation. This course is designed for prospectors and miners and other men of maturity who have had practical experience but who have had no opportunity to acquire a technical education. For such men the school offers, during the midwinter weeks, an opportunity to gain some insight into those principles of their work which practice alone will not provide. Instruction is given in the following subjects: Assaying, Cyaniding, Chemistry, Mineralogy, Geology, Ore Dressing and Mining Law. The tuition fee, payable at time of registration, will be six dollars plus the cost of such materials as may be used up in the laboratories.

A feature of interest is that men having ores or minerals of their own will be given opportunity to make tests upon them in so far as such can be done without interfering with the other work of the institution. Every effort will be put forth to make this work both practical and helpful. No credit toward a degree will be given for work pursued in this course.

Summer School

The summer school in surveying begins immediately after commencement and occurs between the sophomore and junior years. The electrical engineers

spend two weeks in plane surveying, the mining and metallurgical engineering students spend two weeks in plane surveying and one week in underground mining surveying, and the students in civil engineering spend six weeks in surveying as outlined in the civil engineering course. Every effort is exerted to make this work practical and instructive. The mining surveying is done in a suitable mine in the Black Hills, the remainder of the work is done in the vicinity of Rapid City.

Preparatory Department

The School of Mines finds it necessary to maintain a Preparatory Science Course on account of certain sections of the state being without adequate High School facilities. Students from these portions of the commonwealth frequently enter the School of Mines deficient in entrance requirements. It is mainly for their sake that the school maintains this department.

The School of Mines faculty has direct supervision of the work. Two instructors devote their entire time to the department and several of the professors teach one or more subjects. The same laboratory facilities are afforded preparatory students as are enjoyed by the higher classes.

The tuition and incidental fee is $12 per year or $6 per semester.

A special announcement describing the Preparatory Science Course is published and will be sent on application.

Admission to Advanced Standing

Graduates of college and technical schools who enter the school as candidates for a degree will receive proper credit for all such studies which they have completed and which form part of the curriculum of the School of Mines. The faculty decide these cases upon the basis of individual merit.

Degrees

The School of Mines offers two degrees: That of Bachelor of Science in Mining Engineering, to the candidate who has successfully completed the

regular Mining Engineering course, and that of Bachelor of Science in Metallurgical Engineering, to the candidate who has completed successfully the Metallurgical Engineering course.

The degree of Engineer of Mines, or of Metallurgical Engineer, will be conferred upon graduates of the corresponding engineering course of the School, who shall have devoted one year to graduate study in the School of Mines, under the direction of the faculty, passing required examinations upon the studies pursued, or to those who shall furnish evidence of two years successful experience in mining or metallurgical work, and who shall submit an adequate thesis which shall be duly considered and accepted by the faculty before such advanced degree will be granted.

Candidates for the engineer's degree should make application for such not later than December first of the school year in which graduate work is begun.

In order to allow time for correspondence and corrections, the thesis of a non-resident candidate should be submitted not later than April 15th of the year in which the degree is to be granted.

If the completed thesis is approved by the head of the department concerned, he shall transmit it to the committee on advanced degrees with his approval in writing.

A true and perfect copy of the corrected and approved thesis must be filed with the librarian not later than the 20th of May.

Students who complete the studies in the Preparatory department will receive a certificate to that effect.

Thesis

Every candidate for a degree in either engineering course is required to present a thesis on some subject patent to his course before he will receive his degree.

At the beginning of the school year the individual members of the senior class are expected to consult with the thesis committee of the faculty

regarding the subjects for their thesis. Preference will be given to subjects selected by the student, provided they meet the approval of the committee. Students unable to select subjects for themselves will be assigned subjects by the committee.

Report of progress in thesis work must be made at stated intervals to the thesis committee. Thesis must be submitted to the faculty not later than May 15th, and must be typewritten on paper 8 1-2x11 inches in size. Two copies must be furnished; one for the department within which the thesis falls, and one for the library. No degree will be granted unless the conditions concerning thesis are fully satisfied.

The following is a list of the theses submitted since 1903:

1904. Arentz, S. S. Some Experiments on Bromo-Cyanogen.

Hall, Arthur E. Some Features Illustrating ing the Quantitative Chemistry of the National Smelter Blast Furnaces.

West, Elmer W. Notes on Assay Slags.

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Ives, Glen P., and Ossa, Ignatio D. Metallurgical Treatment of Jamesonite Ores.

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Ledyard, L. W. The Cleopatra Mine.

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Sayville, Joseph H. The Possible Development of the Deep Down Property and Treatment of its Ore.

Stoner, J. W., and Elliott, J. W. A Hypothetical Mine.

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Brooks, Floyd R. Investigation Concerning the Melting Points of a Series of Copper Slags.

Ehle, Chester G. Gypsum Deposits and the Stucco Industry in the Black Hills.

Quinney, E. H., and Winsor, F. H. Jr. Cyanide Tests on a Refractory Siliceous Ore of the Northern Black Hills.

Willard, C. G., and Muhmel, F. J. Investigations of Fire Clays Near Rapid City.

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Henton, Hugh M. Some Experiments in Analysis of Titanium, Magnesium, Zinc.

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Eldredge, Robert B. Experiments in Ore Flotation.

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Hill, Robert S. Notes on Beryllium.

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Meents, R. O. Leaching A Copper Ore.

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Stowell, George E. The Geology of Silver City and Vicinity.

1915. Booth, L. E., and Thiel, Arthur. Electrolysis of Alkaline Solutions of Potassium Sulphocyanide.

Gates, C. E. The Design of a Plant for a Southeastern Missouri Lead Mine.

O'Harra, B. M. The Gold-Bearing Quartz-Tremolite Series of the Black Hills.

1916. Cragin, Rodney S. Tests for Gold and Silver of the Country Rock of the Black Hills.

Dennis, Paul Joseph. Experiments in Making Brick from the Graneros and Pierre Shales.

Hill, Joseph Henry. The Refining and Recovery of Gold from Dental Scrap.

Smith, Elwyn L. Radio-active Minerals of the Black Hills.

COURSES AND DEPARTMENTS

All courses offered by the School of Mines require four years for completion. They are as follows: Mining Engineering, Metallurgical Engineering, Civil Engineering, and Electrical Engineering.

Synopsis of Courses

MINING ENGINEERING COURSE

First Year

	Hours per week.	
First Semester—	Lectures	Lab.
Mathematics 7—Trigonometry	5	
Chemistry 3—General	4	6
Geology 1—General	4	3
English 9—Composition	4	
Civil Engin. 1—Mechanical Drawing		6
	17	15

Second Semester—	Lectures	Lab.
Mathematics 8—Analytic Geometry	5	
Chemistry 4-6—General and Qualitative	4	6
Geology 2—General	4	3
English 10—Composition	4	
Civil Engin. 2—Mechanical Drawing		6
	17	15

Second Year

First Semester—	Hours per week. Lectures	Lab.
Mathematics 9—Calculus	5	
Chemistry 7—Qualitative	3	6
Mineralogy 1—General	2	3
Civil Engin. 3—Descriptive Geometry		6
Civil Engin. 5—Surveying	3	3
Mining 1—Breaking ground	3	
	16	18

Second Semester—	Lectures	Lab.
Mathematics 10—Calculus	5	
Chemistry 8—Quantitative	2	12
Mineralogy 2—Blow-pipe	2	6
Civil Engin. 6—Surveying	3	3
Mining 2—Tunneling, shaft sinking	2	
	14	21

Summer surveying three weeks.

Third Year

First Semester—	Hours per week. Lectures	Lab.
Physics 3—General	3	3
Physics 5—Analytic mechanics	4	
Geology 3—Petrology	3	4½
Civil Engin. 7—Topographic drawing		1½
Civil Engin. 9—Machine design		6
Metallurgy 1—General	3	
Mining 3—Ore dressing	3	3
	16	18

Second Semester—	Lectures	Lab.
Physics 4—General	4	6
Civil Engin. 14—Mechanics of materials.	4	
Geology 4—Physical geology	3	
Economics	3	
Metallurgy 2—Assaying	2	9
Civil Engin. 10—Graphics		3
Mining 4—Ore dressing	2	
	18	18

Fourth Year

First Semester—	Hours per week. Lectures	Lab.
Elec. Engin. 3—General	4	3
Geology 5—Economic	4	
Mining 5-7—Mine operation	5	
Mining 9—Mine design		6
Metallurgy 3—Gold and silver	3	
Metallurgy 5—Copper and lead	2	
Metallurgy 11—Laboratory		3
Thesis		3
	18	15

Second Semester—	Lectures	Lab.
Physics 6—Hydraulics	2	1½
Steam Engineering—Power plants and thermodynamics	3	1½
Geology 6—Economic	4	
Mining 6-8—Mining operation	5	
Mining 10—Mine design		6
Mining 12—Mine accounting	2	
Mining 14—Mining law	1	
Metallurgy 4—Iron and steel	2	
Thesis		6
Metallurgy 12—Mill run		week
	19	15

METALLURGICAL ENGINEERING COURSE

First Year

First Semester—	Hours per week. Lectures	Lab.
Mathematics 7—Trigonometry	5	
Chemistry 3—General	4	6
Geology 1—General	4	3
English 9—Composition	4	
Civil Engin. 1—Mechanical drawing		6
	17	15

Second Semester—	Lectures	Lab.
Mathematics 8—Analytic geometry	5	
Chemistry 4-6—General and qualitative	4	6
Geology 2—General	4	3
English 10—Composition	4	
Civil Engin. 2—Mechanical drawing		6
	17	15

Second Year

First Semester—	Hours per week. Lectures	Lab.
Mathematics 9—Calculus	5	
Chemistry 7—Qualitative	3	6
Mineralogy 1—General	2	3
Civil Engin. 3—Descriptive geometry		6
Civil Engin. 5—Surveying	3	3
Mining 1—Breaking ground	3	
	16	18

Second Semester—	Lectures	Lab.
Mathematics 10—Calculus	5	
Chemistry 8—Quantitative	2	12
Mineralogy 2—Blow-pipe	2	6
Civil Engin. 6—Surveying	3	3
Mining 2—Tunneling, shaft sinking	2	
	14	21

Summer Surveying three weeks.

Third Year

First Semester—	Hours per week. Lectures	Lab.
Physics 3—General	3	3
Physics 5—Analytic mechanics	4	
Chemistry 9—Metallurgical	2	6
Civil Engin. 7—Topographic drawing		1½
Civil Eng. 9—Machine design		6
Mining 3—Ore dressing	3	3
Metallurgy 1—General	3	
	15	19½

Second Semester—	Lectures	Lab.
Physics 4—General	4	6
Civil Engin. 14—Mechanics of materials	4	
Chemistry 10—Applied physical	2	
Economics	3	
Metallurgy 2—Assaying	2	9
Civil Engin. 10—Graphics		3
Mining 4—Ore dressing	2	
	17	18

Fourth Year

First Semester—	Hours per week. Lectures	Lab.
Elec. Engin. 3—General	4	3
Metallurgy 7—Gold and silver	4	
Metallurgy 9—Copper and lead	5	
Metallurgy 13—Laboratory		6
Metallurgy 15—Laboratory		9
Mining 5—Mine operation	2	
Thesis		3
	15	21

Second Semester—	Lectures	Lab.
Physics 6—Hydraulics	2	1½
Steam Engineering—Power plants and thermo dynamics	3	1½
Metallurgy 4—Iron and Steel	2	
Metallurgy 6—Electrometallurgy	2	

Metallurgy 8—Calculations	2	
Metallurgy 10—Metallurgical design		6
Mining 6—Compressed air	2	
Mining 12—Mine accounting	2	
Mining 14—Mining law	1	
Thesis		6
Metallurgy 12—Mill run		week
	16	15

CIVIL ENGINEERING COURSE

First Year

First Semester—	Hours per week. Lectures	Lab.
Mathematics 7—Trigonometry	5	
Chemistry 3—General	4	6
Geology 1—General	4	3
English 9—Composition	4	
Civil Engin. 1—Mechanical drawing		6
	17	15

Second Semester—	Lectures	Lab.
Mathematics 8—Analytic geometry	5	
Chemistry 4-6—General and qualitative	4	6
Geology 2—General	4	3
English 10—Composition	4	
Civil Engin. 2—Mechanical drawing		6
	17	15

Second Year

First Semester—	Hours per week. Lectures	Lab.
Mathematics 9—Calculus	5	
Physics 3—General	3	3
Mineralogy 1—General	2	3
Civil Engin. 3—Descriptive geometry		6
Civil Engin. 5A—Surveying	3	6
Mining 1—Breaking ground	3	
	16	18

Second Semester—	Lectures	Lab.
Mathematics 10—Calculus	5	
Physics 4—General	4	6
Civil Engin. 8—Astronomy	2	
Civil Engin. 4A—Descriptive geometry		6
Civil Engin. 6A—Surveying	3	6
Mining 2—Tunneling, shaft sinking	2	
	16	18

Summer surveying six weeks.

Third Year

	Hours per week.	
First Semester—	Lectures	Lab.
Physics 5—Analytic mechanics	4	
Civil Engin. 7A—Topographic drawing		3
Civil Engin. 11—Graphics		3
Civil Engin. 13—Railroad engineering	4	3
Civil Engin. 9—Machine design		6
Civil Engin. 15—Cement and concrete	2	
Metallurgy 1—General	3	
Sociology	3	
	16	15

Second Semester—	Lectures	Lab.
Civil Engin. 14A—Mechanics of materials	5	
Civil Engin. 16—Testing	2	6
Civil Engin. 12—Graphics		3
Civil Engin. 18—Stereotomy		3
Civil Engin. 26—Sewers	2	
Steam Engineering—Power plants and thermodynamics	3	1½
Metallurgy 4—Iron and steel	2	
Economics	3	
	17	13½

Fourth Year

	Hours per week.	
First Semester—	Lectures	Lab.
Elec. Engin. 3—General	4	3
Civil Engin. 23—Roofs and bridges	3	6

Civil Engin. 25—Dams and retaining walls	3	
Civil Engin. 27—Arches and foundations	2	
Civil Engin. 29—Roads and pavements	3	
Civil Engin. 31—Contracts and specifications	1	
Thesis		6
	16	15

Second Semester—	Lectures	Lab.
Physics 6A—Hydraulics	4	3
Civil Engin. 24—Roofs and bridges	3	6
Civil Engin. 30—Irrigation, water power and supply	5	
Civil Engin. 32—Framed structures	3	3
Thesis		6
	15	18

ELECTRICAL ENGINEERING COURSE

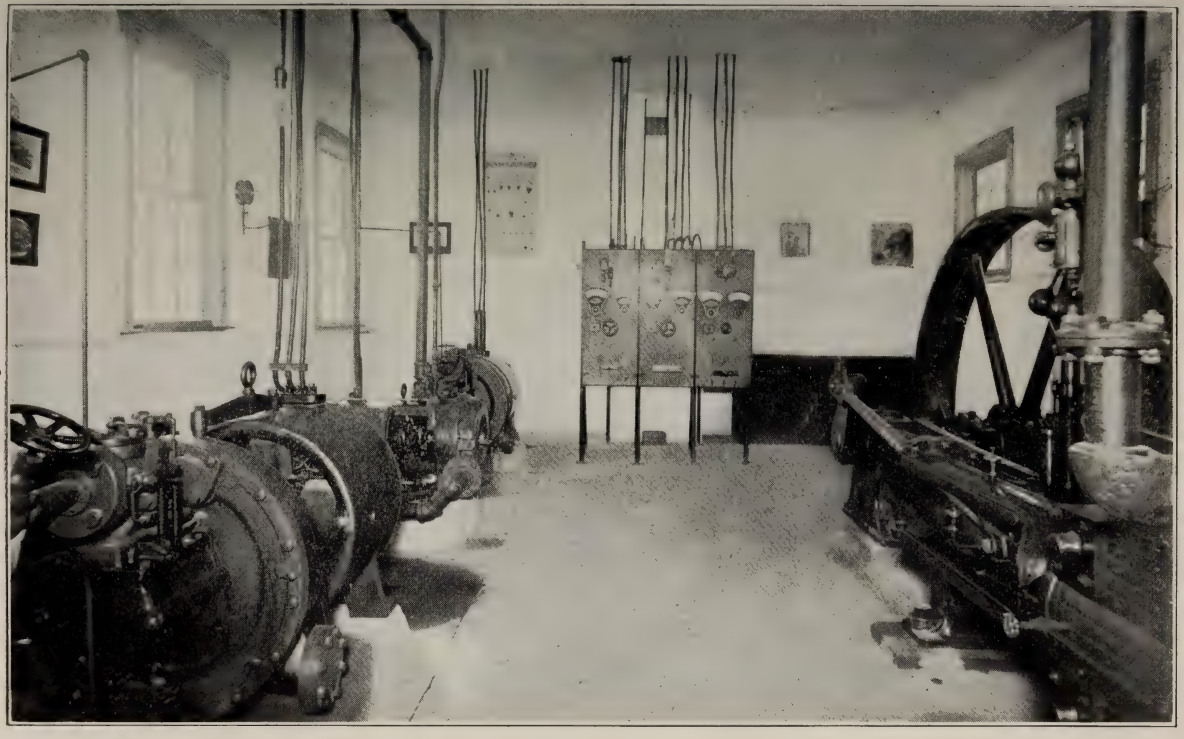
First Year

First Semester—	Lectures	Lab.
Mathematics 7—Trigonometry	5	
Chemistry 3—General	4	6
Geology 1—General	4	3
English 9—Composition	4	
Civil Engin. 1—Mechanical drawing		6
	17	15

Second Semester—	Lectures	Lab.
Mathematics 8—Analytic geometry	5	
Chemistry 4-6—General and qualitative	4	6
Geology 2—General	4	3
English 10—Composition	4	
Civil Eng. 2—Mechanical drawing		6
	17	15

Second Year

	Hours per week.	
First Semester—	Lectures	Lab.
Mathematics 9—Calculus	5	



PART OF POWER PLANT, SHOWING THREE ELECTRIC GENERATORS AND CORLISS ENGINE

Elec. Engin. 1—Elementary	2	3
Civil Engin. 3—Descriptive geometry		6
Civil Engin. 5—Surveying	3	3
Civil Eng. 9—Machine design		6
Physics 3—General	3	3
	13	21

Second Semester—	Lectures	Lab.
Mathematics 10—Calculus	5	
Elec. Engin. 2—Elementary	2	3
Civil Engin. 4—Descriptive geometry		3
Civil Engineering 6E—Surveying	1½	3
Civil Engin. 10—Graphics		3
Physics 4—General	4	6
	12½	18

Summer surveying two weeks.

Third Year

	Hours per week.	
First Semester—	Lectures	Lab.
Mathematics 11—Differential equations	3	
Physics 5—Analytic mechanics	4	
Elec. Engin. 3—General	4	3
Elec. Engin. 5—Measurements		6
Elec. Engin. 3A		6
Sociology	3	
Metallurgy 1—General	3	
	17	15

Second Semester—	Lectures	Lab.
Physics 6—Hydraulics	2	1½
Steam Engineering—Power plants and thermodynamics	3	1½
Civil Engin. 16E—Testing laboratory	2	3
Civil Eng. 14—Mechanics of materials	4	
Economics	3	
Elec. Eng. 8—A. C. Laboratory		6
Elec. Engin. 10—A. C. Theory	4	
Shop Work 8—Winding laboratory		3
	18	15

Fourth Year

First Semester—	Hours per week. Lectures	Lab.
Electro-metallurgy	2	
Electro-chemistry	3	
Elec. Engin. 9—Distribution and control	3	
Elec. Engin. 11—A. C. machinery	4	
Elec. Engin. 13—Laboratory		6
Elec. Engin. 15—A. C. theory	3	
Electrical Design		6
Thesis		6
	15	18

Second Semester—	Lectures	Lab.
Elec. Engin. 12—Hydro-electric plants	3	
Elec. Engin. 14—Laboratory		6
Elec. Engin. 16—Telegraphy and telephony	2	
Elec. Engin. 18—Elec. railways	3	
Elec. Engin. 20—Steam-electric plants	2	
Elec. Engin. 22—Illumination	2	
Elec. Engin. 24—Management	3	
Electric Design		6
Thesis		6
	15	18

Engineering students wishing to study Spanish, French or German, have the privilege of taking a five hour course in these subjects by making proper arrangements therefor, providing the total number of lecture hours carried does not exceed eighteen per week.

PREPARATORY SCIENCE COURSE

First Year

First Semester—	Hours per week. Lectures	Lab.
Mathematics 1—Algebra	5	

English 1—Composition	5	
Biology 1—General biology	3	3
History 1—Ancient history	5	
Shop Work 1—Wood shop		6
	18	9

Second Semester—	Lectures	Lab.
Mathematics 2—Algebra	5	
English 2—Composition	5	
Biology 2—General biology	3	3
History 2—Mediaeval history	5	
Shop Work 2—Wood shop		6
	18	9

Second Year

First Semester—	Lectures	Lab.
Mathematics 3—Geometry	5	
English 3—Rhetoric	5	
History 3—Modern history	5	
Biology 3—Botany	3	3
Shop Work 3—Forging		3
	18	6

Second Semester—	Lectures	Lab.
Mathematics 4—Geometry	5	
English 4—Rhetoric	5	
History 4—U. S. history	5	
Biology 4—Botany	3	3
Shop Work 4—Molding and casting		3
	18	6

Third Year

First Semester—	Lectures	Lab.
French 1 or Spanish 1	5	
German 1	5	
Biology 5—Zoology	3	6
English 5 or 7—English or American Literature	5	
Freehand drawing		3
	18	9

Second Semester—	Lectures	Lab.
French 2 or Spanish 2	5	
German 2	5	
Astronomy	3	3
English 6 or 8—English or American Literature	5	
Physical Geography	3	3
Freehand Drawing		3
	21	9

Fourth Year

First Semester—	Lectures	Lab.
Chemistry 1	3	6
German 3 or 5, French 3 or Spanish 3	5	
Physics 1	4	6
Mathematics 5—Geometry	5	
	17	12

Second Semester—	Lectures	Lab.
Chemistry 2	3	6
German 4 or 6 or French 4 or Spanish 4	5	
Physics 2	4	6
Mathematics 6—Algebra	5	
	17	12

Geology and Mineralogy

Professor O'Harra Professor Runner

Library, Laboratory and Field Facilities

A good, well equipped departmental library is placed convenient to the lecture and laboratory rooms and students are required to make intelligent use of the literature contained therein.

The laboratory equipment and the museum collections, elsewhere described, furnish indispensable material for practical work of many kinds.

Field facilities are unsurpassed. Unusual opportunity is offered for study in the field of the various geological horizons, including important and valuable economic deposits. Within a few miles of the School the student may observe upturned strata of nearly all geological ages. Twenty miles southwest of Rapid City is the Harney Peak granite area, with its lavish variety of mineral specimens. Surrounding this is a wonderful exposure of Algonkian metamorphic rocks cut in many places by auriferous quartz veins. The Cambrian, Carboniferous, Triassic, Jurassic, and Cretaceous are etxensively developed. The famous White River Badlands of Tertiary age lie to the southeast of the Hills and afford fossils which have made the region known wherever the science of Paleontology is taught. In the northern part of the Hills important igneous rocks, such as rhyolite, phonolite, andesite, dacite, etc., occur in the form of dikes, sheets and laccoliths. Closely associated with these in slates, quartzites, and limestones, gold ores of the greatest importance are found.

In the autumn, short field excursions are made by

the class to nearby points of interest and occasionally a visit of several days is made to more distant localities. Thus the student, in addition to lecture and laboratory instruction, has the advantage of systematically directed field study and with the information thus gained, he should be able to undertake for himself the working out of practical field problems.

Geology 1-2

General Geology: This course is arranged primarily as introductory to all work in geology and mineralogy. It extends throughout the Freshman year and embraces a comprehensive study of the fundamental principles of geology. The course includes brief, but careful study of dynamical, stratigraphical, structural, chemical and historical geology, and is conducted by means of lectures, text books, and laboratory work, and frequent excursions to points of particular interest. Under dynamic geology, the atmospheric, aqueous, igneous, and organic agencies are discussed with reference to their bearing on the present and past condition of the earth's surface. Stratigraphical and structural geology consider the conditions of deposition of sediments and of the disturbance of rock masses. A portion of the time alloted to these subjects is evote to the study of such minerals and rocks as enter most largely into the structure of the earth's surface; also to the methods of geological surveying, including mapping, section making, special problems. Chemical gelology includes the study of the general relation which chemistry bears to geological phenomena, such as the formation, metamorphism, and degeneration of rocks, and the origin and alterations of the various kinds of mineral deposits. Under historical geology, the physical history of the earth is discussed, the classification and distribution of sedimentary rocks studied, and the methods of correlation explained. The course aims to equip the student with useful information concerning the phenomena and history of the earth, so that he may know the methods used in geological research, and will better understand how to interpret facts gained in the study of economic deposits.

Freshman Year. Four lecture periods and three laboratory hours per week throughout the year.

Text Book: Pirsson & Schuchert's Text-book of Geology.

Mineralogy 1

Crystallography: Eight weeks are given to the study of symmetry, forms and classifications of crystals. In the laboratory the student becomes familar with the various types of crystals through the study of models and later is required to identify the forms of one hundred mineral crystals.

Physical Mineralogy: The remainder of the semester is devoted to the physical properties of minerals in general and the composition, forms, properties, occurrence, association, origin and uses of one hundred of the more common minerals are studied in detail. In the laboratory seven hundred unlabeled specimens of the minerals discussed in the class room are determined from their physical properties alone. The course is planned to develop such information as may be needed for the quick and accurate determination of minerals in the field.

Sophomore Year, First Semester. Two lecture periods and three laboratory hours per week. Text: Rogers' Study of Minerals.

Mineralogy 2

General Mineralogy and Blowpipe Analysis: The chemical properties and relations of minerals and the methods of blowpipe and other chemical analyses for their determination are first studied, after which the chemical and physical properties, origin, associations and uses of about one hundred mineral species are taken up, special emphasis being paid to ore and common rock forming minerals. The laboratory work consists of the determination of approximately one thousand four hundred unlabelled specimens of minerals by means of chemical tests and physical properties. A detailed report of all results obtained is made out and kept for reference. It is expected that upon completion of this and the preceding course the student will have gained a good

working knowledge of over two hundred of the common minerals including the chief factors of their distribution, uses, value and output.

Sophomore year, Second Semester. Two lecture periods and six laboratory hours per week.

Text Books: Rogers' Study of Minerals. Lewis' Determinative Mineralogy.

Geology 3

Optical Mineralogy: This course is mainly introductory to the study of Petrography. Its aims to enable the student to recognize the common minerals by means of the miscroscope. A discussion of the principles and phenomena of light, such as reflection, refraction, interference is offered and the different media and their wave fronts, optical signs and indicatrices receive special attention. This is succeeded by an application of these laws in the movement of light in different crystals, and the use of the petrographic microscope in the identification of minerals in thin sections. For laboratory work excellent Zeiss and Leitz microscopes are available. The fairly extensive collection of thin sections includes a special set of 120 oriented mineral sections manufactured by Krantz.

Petrography: This course is intended for mining students who need some training in rock determination, but who have opportunity to devote only a short time to the subject. It embraces the study of rock, both under the microscope and in hand specimens. The lectures are devoted to a general discussion of the principles of rock classification, special attention being given to the system of Zirkel, and Rosenbusch modified as in use in America, which is followed by a brief summary of the Quantitative system. The origin, distribution, mode of occurrence, and relations of rock masses and contact metomorphism are included. The principles of regional metamorphism and a classification of metamorphic rocks follow. For the laboratory work a Kranz collection of 350 rocks and thin sections is available. In addition there is a fairly complete collection of Black Hills rocks, most of which are thin sectioned. There

is also a set of unlabeled rocks with accompanying thin sections representing all common types, which are used for description and study by the student.

The Black Hills offer an exceedingly interesting field for the petrographer on account of the great variety of rock types within their small area. When possible field excursions will be taken to points of interest, especially to the metamorphic and igneous areas.

Junior Year, First Semester, Mining Engineering option: Three lecture periods and four and one-half laboratory hours per week.

Reference books. Manual of Petrographic Methods, Johannsen. Determination of Rock Forming Minerals, Johannsen. Rock Minerals, Iddings. Igneous Rocks, Iddings. Igneous Rocks and Their Origin, Daly. The Natural History of Igneous Rocks, Harker. Petrology for Students, Harker. Lecture Notes.

Geology 4

Structural Geology: The course begins with a resume of the different hypotheses of earth origin and those concerning the interior condition of the earth. Vulcanism in its broader aspects, its causes and manifestations is next taken up followed by a brief summary of the modern ideas on diastrophism and isostasy. Rock fractures, flowage, faults and folds are discussed in their relations to deformative stresses and the major units of earth structure in their proper relations. Special attention is given to the solution of problems in faulting and folding that have a bearing on the practical work of the miner.

Junior Year, Second Semester, Mining Engineering option. Three lecture periods per week.

Reference Texts: Leith's Structural Geology. Leith & Meads' Metamorphic Geology. Lahee's Field Geology.

Geology 5-6

Economic Geology: This course runs throughout the Senior year and includes study of the origin, modes of occurrence and uses of economic mineral

products. About one-half of the first semester is given to the study of non-metallic products. This includes the origin, nature, relations and values of coal, petroleum, natural gas, salines, building stone, clays, cement materials, fertilizers, abrasives, gems, etc. The rest of the course is devoted to the study of metallic products, such as gold, silver, copper, iron, lead, zinc, platinum, mercury, nickel, etc. In this much attention is given to the study of the principles of ore deposition and to the historical development of the theories connected therewith. Careful attention is given to the chief types of deposits and particularly to localities noted for their wealth of output.

Maps, specimens, and original papers are freely used. Attention is given to the history of mineral development, of the life and comparative importance of various regions and of the influence which economic deposits have exerted upon the regions or countries in which such deposits have been found.

Th necessity of individual examination by the student of the best up-to-date literature is insisted upon, and a reasonable ability to properly use such literature is required. Much attention is devoted to the study of the many economic interests of the Black Hills region and observation of the deposits in the field is encouraged.

Senior Year, Mining Engineering Option: Four lecture periods per week throughout the year.

Reference Texts: Beck-Weed's Nature of Ore Deposits; Ries' Economic Geology; Kemp's Ore Deposits of the United States and Canada; Lindgren's Mineral Deposits; Beyschlag, Vogt & Krusch's Ore Deposits.

Civil Engineering

Professor Steele

The aim of this department is to give the student such training in the class room, drawing room, laboratory and field as will properly fit him for entrance to an engineering career.

The endeavor will be to give him enough practical knowledge to enable him on graduation to fill with credit a subordinate professional position and to teach him so much of the underlying theory and principles as to permit him when he has clothed these with experience of his own to rise to the higher ranks of his calling.

The department occupies two well lighted drawing rooms, 24x34 and 24x30 feet in size, lecture rooms and offices. The drawing rooms are furnished with suitable drawing desks which have separate lockers for each student.

The work of this department extends over a period of four years and includes the following courses :

Civil Engineering 1-2

Mechanical Drawing: Practical work in the drawing room accompanied by lectures as needed. The work is carried on chiefly by means of individual instruction. The course includes the care and use of instruments; the mounting of sheets; simple geometric constructions; orthographic, isometric and cabinet projection, machine details, and both free hand and mechanical lettering of titles. Tracing and blue printing are taught in this course.

Students taking this course should provide themselves with the following list of supplies, most of

which may be obtained from the supply room of the department at cost:

One set of drawing instruments containing:
One pair 6-in. compasses, with pen, pencil and needle points.
One pair 6-in. dividers,
One 5½ in. ruling pen,
One 3½ in. steel spring bow divider.
One 3½ in. steel spring bow pencil,
One 3½ in. steel spring bow pen,
One T square with 30 in. blade,
One 4½ in. protractor,
One irregular curve,
One 7 in. 30° by 60° triangle,
One 8 in. 45° triangle.

Drawing paper, pencils, ink, erasers, etc., may be purchased from the department at cost.,

French's Engineering Drawing is used as a text book.

Drawing boards and key for locker are furnished by the school on the payment of a fee of $1 per year; 50 cents of this is refunded on return of key and board.

Freshman Year: Six laboratory hours per week throughout the year.

Civil Engineering 3-4

Descriptive Geometry: This work includes the projection of the point and the line and the representation of planes, with numerous problems relating thereto, and the generation, classification and intersection of curves and surfaces. Drafting room work with individual talks.

Sophomore Year, First Semester: Six laboratory hours per week; second semester, three laboratory hours per week.

Text Book: Hall's Descriptive Geometry, with Plates.

Civil Engineering 4A

Descriptive Geometry: Similar to Civil Engineering 4, but including shades, shadows, and perspective.

Sophomore Year, Second Semester: Six Laboratory hours per week.

Civil Engineering 5-6

Surveying. Plane Surveying. It is the desire of the department to bring, as far as it is practicable, theory and practice side by side. Ample opportunity for field work is provided and the institution is provided with all the instruments and accessories necessary to carry on the work. Additional instruments are purchased as the need for them arises.

For the performance of the field work, the class is divided into squads with just sufficient number in each party to properly carry on the work. Each student is required to take his turn at every part of the work; to use each instrument as the occasion demands; to make his notes and computations; and finally to accurately plot them in the drawing room.

The course outlined is as follows: Linear measurements by means of pacing and chain or tape; adjustment and use of the engineer's transit and level; traversing; principles of land surveying; adjustments and use of the plane-table; adjustment and use of the solar instrument; topographic surveying, determination of the meridian by means of the solar instrument; direct solar observation and observation on Polaris; measurements of volumes. Railroad surveying and city surveying will receive as much time as the conditions will permit. Trigonometry is a prerequisite.

Mine Surveying: The location and patent survey of mineral claims; carrying the meridian underground via vertical and inclined shafts; underground traversing and leveling; underground connections; measurements of ore reserves and stope volumes; note taking and plotting.

Sophomore Year: Three lecture periods and three hours field work per week during the year.

A three week's summer school for practical work immediately follows the close of school in June. This includes two weeks of plane surveying and one week of mine surveying underground.

Text Book: Johnson's Theory and Practice of Surveying.

Civil Engineering 5A-6A

Surveying: Course similar to Civil Engineering 5-6, but amplified for Civil Engineering students. In addition to the subjects mentioned under the preceding course, this course treats of geodetic surveying including base line measurement, triangulation and measurement of angles, trigonometric and precise levelling and map projection

Three hours lectures and six hours field work per week during the Sophomore year, followed by six weeks summer field work.

Civil Engineering 6E

Plane Surveying: Same as Plane Surveying under Course 6, but does not include Mine Surveying. Sophomore Year, Electrical Engineering Course, Second Semester. Three hours lectures per week for one half semester; three hours field work per week for one semester, followed by two weeks summer field work.

Civil Engineering 7

Topographic Drawing: This work embraces the accurate drawing of maps, including topographic features, and the plotting of profiles. Many of the notes taken in the preceding summer's field work are thus worked up in the drafting room.

Prerequisite Civil Engineering 5-6.

Junior Year, First Semester: Three laboratory hours per week for eight weeks.

Civil Engineering 7A

Topographic Drawing: This course includes the same subjects as Course 7, but the work is amplified for Civil Engineering students. Prerequisite Civil Engineering 5A-6A.

Junior Year, First Semester: Three laboratory hours per week.

Civil Engineering 8

Astronomy: A short course in Field Astronomy

for Civil Engineering students, special attention being given to the observations for azimuth, latitude, longitude and time. The school possesses a superior three inch astronomical telescope with achromatic finder and four eye pieces. Sophomore year, Second Semester: Two lecture periods per week.

Civil Engineering 9

Machine Design: The drawing of screw threads, keys, fastenings, the various forms of gear teeth, bevel gears, bearings, cams, quick return motions, etc. It is designed to make this course eminently practical, an introduction to those problems which continually meet the designing engineer and which the principles of machine design alone will help him to solve. Drafting room work with talks as needed, and library references.

Junior Year, First Semester: Six laboratory hours per week

Civil Engineering 10-11-12

Graphical Statics: The object of this course is to give an understanding of the theory of the graphical solution of internal stresses in a framed structure, arising from steady and moving loads, from the pressure of the wind, etc. The student is required to determine by graphical methods on the drawing board, the nature and amounts of internal stresses in the various members of such simple roof and bridge trusses and head frames as are assigned him.

Junior Year: Three laboratory hours per week. Courses 11-12 is for Civil Engineering students and extends throughout the year. Course 10 is for all other students and is given during the second semester.

Text Book: Hoskins, Elements of Graphic Statics.

Civil Engineering 13

Railroad Engineering: The organization of a railroad company, the permanent way, rails, ties, road-bed, ballast, bridges, culverts, yards, elevation

of outer rail, signals, locomotives, curves and grade problems, surveying for location and construction. Plane surveying is a prerequisite. Raymond's Elements of Railroad Engineering is used.

Junior Year, First Semester, Civil Engineering Course. Four letcture hours and three laboratory hours per week.

Civil Engineering 14

Mechanics of Materials: The resistance and elasticity of the materials of engineering; fundamental assumptions of the common theory of beams; distribution of stresses in beams; shearing forces, bending moments, and deflections of beams; the theory of torsion, flexure, elastic limits; working stresses and ultimate stresses and ultimate resistance of cast iron, wrought iron, steel and timber; pipes and riveted joints; posts and columns; the design of posts, beams, shafts, etc.

Junior Year, Second Semester: Four lecture periods per week.

Text Book: Merriman's Mechanics of Materials.

Civil Engineering 14A

Mechanics of Materials: This is a somewhat more extended course than the preceding, and is given five lecture hours per week. It includes all the work given in the text book above mentioned.

Junior Year, Second Semester, Civil Engineering Course.

Civil Engineering 15

Cement and Concrete: The composition, manufacture and use of Portland and natural cements, the mixing and placing of plain and reinforced concrete, the theory and calculation of reinforced concrete

Junior Year, First Semester, Civil Engineering Course. Two lecture periods per week.

Civil Engineering 16

Testing Materials: A laboratory course with explanatory lectures. Must be accompanied or preceded by Civil Engineering 14 or 14A.

Junior Year, Second Semester, Civil Engineering Course. Two hours lectures and six hours laboratory work per week.

Civil Engineering 16E

Testing Materials: A course for Electrical Engineering students, similar to Civil Engineering 16, but with the laboratory work abridged to three hours per week. Second Semester, Junior Year.

Civil Engineering 18

Stereotomy: Drafting room work with lectures as needed. Descriptive geometry applied to the detail drawing of masonry arches and other structures with plane, curved or warped surfaces. The drawing room courses of the first two years are prerequisites.

Junior Year, Second Semester, Civil Engineering Course. Three laboratory hours per week.

Civil Engineering 23-24

Roofs and Bridges: A study of the usual designs of roof and bridge trusses, with calculations of stresses and drawing room work in design. Must be preceded by Civil Engineering 11-12.

Senior Year, Civil Engineering Course. Three lecture periods and six laboratory hours per week during the year.

Civil Engineering 25

Dams and Retaining Walls: A study of various types of dams and weirs, including timber, earth, masonry and rock fill dams, and of retaining walls

Senior Year, First Semester, Civil Engineering Course. Three lecture periods per week.

Civil Engineering 26

Sewers: The various ways of disposal of sewage, sewer design and construction.

Junior Year, Second Semester, Civil Engineering Course. Two lecture periods per week.

Civil Engineering 27

Arches, Masonry and Foundations: The theory and design of arches, the methods and materials of construction of foundations and masonry structures.

Senior Year, First Semester, Civil Engineering Course. Two lecture periods per week.

Civil Engineering 29

Roads and Pavements: The modern construction of earth roads, country highways, city streets and pavements, materials, methods, economics and costs.

Senior Year, First Semester, Civil Engineering Course. Three lecture periods per week.

Civil Engineering 30

Irrigation, Water Power and Supply: The storage and distribution of water for irrigation and power. Water works for small cities.

Senior Year, Second Semester, Civil Engineering Course. Five lecture periods per week.

Civil Engineering 31

Contracts and Specifications. A course of one hour per week of reading and recitations.

Senior Year, First Semester, Civil Engineering Course

Civil Engineering 32

Framed Structures: Structural details, the principles of detail design of members and joints in timber and steel construction.

Senior Year, Second Semester, Civil Engineering Course. Three lecture periods and three laboratory hours per week.

Physics and Electrical Engineering

Professor Swisher

The courses in Physics are designed to give to the student a broad, general knowledge of the whole subject, as well as the knowledge most essential to his work as a mining or a metallurgical engineer.

In Electrical Engineering the courses of the first three years are intended to lay the foundations for study in both direct and alternating current work. During the fourth year more specialized courses are offered giving opportunity to apply the general principles to more technical problems.

The courses offered by the department are as follows:

Physics 3

Mechanics of Solids and Fluids, Sound and Heat: In mechanics especial attention is given to the empirical and practical aspects of the subject, while the more theoretical results are considered in Physics 5. Particular emphasis is laid upon the laws of motion, friction, work and energy, and hydromechanics.

In heat particular attention is given to the expansion of gases and vapors, specific heat, and to the energy relations of heat, giving the student a good foundation for Thermodynamics.

The aim of the laboratory work in this and the following course is not so much to perform a large number of experiments as to learn to work with care and accuracy. Determinations are made of the coefficient of friction, specific gravity, velocity, rate of vibration and analysis of sounds.

In heat especial attention is given to the determination of calorific power of fuels, specific and

latent heat, melting and boiling points, coefficient of expansion of solids, liquids and gases, and the determination of the energy equivalent of heat, and the plotting of cooling and freezing point curves.

First Semester: Sophomore Year for Civil and Electrical Engineers, Junior Year for Mining and Metallurgical Engineers. Three lecture periods and three laboratory hours per week.

Text Book: Reed and Guthe-College Physics.

Physics 4

Magnetism and Electricity, Light: The subject of electricity receives detailed consideration. The laws of electrostatics, resistance, electrolysis, electromagnetism and electromagnetic induction are considered in detail, and a careful study of the theory of electrical measurements is made

The subject of light is considered from the standpoint of the electro-magnetic theory and a careful study is made of reflection, refraction, dispersion, interference, diffraction and polarization and of the theory of optical measurements.

The equipment for optics and electrical measurements in the accompanying laboratory work is described on page 20 and is ample for effective work along these lines.

The school machine shop is at the disposal of students for the purpose of constructing apparatus for research work.

Second Semester, as above. Four lecture periods and six laboratory hours per week.

Physics 5

Analytic Mechanics: In this course the fundamental principles of mechanics are developed and a large number of problems are worked giving the practical applications of these principles to engineering. Special effort is made to develop in the student the ability to attack and work out problems for himself. Calculus methods are used freely when needed.

Some of the more important topics taken up are as follows: Composition and resolution of forces; conditions of equilibrium; centers of gravity; mo-

ments of inertia; laws of motion; friction; work and energy.

Junior Year, First Semester: Four lecture periods per week.

Physics 6

Hydraulics: The student takes up this course with a knowledge of hydrostatics from his work in Physics 3, and is thus prepared to commence with hydraulics proper, or the study of the laws governing the motion of water.

The school is favorably situated for field work in hydraulics. Rapid creek is a mountain stream with a fall of about 1.6 per cent., offering splendid facilities for wier and velocity measurements; two large irrigation ditches are adjacent to the school, and Rapid City has three water-power plants within the city limits. The students thus have opportunity to visit and study hydraulic power plants in successful operation.

Senior Year, Second Semester: Two lecture periods per week, and three laboratory hours per week for eight weeks Junior Year for Electrical Engineering students.

Text Book: Mansfield Merriman's Treatise on Hydraulics.

Physics 6A

Hydraulics: A more extended course than Physics 6, for Civil Engineering students.

Senior Year, Second Semester. Four lecture periods and three laboratory hours per week.

Electrical Engineering 1-2

An elementary course in electrical manipulation for Electrical Engineering students including telephone and telegraph circuits, wiring, bells, wiring diagrams and elementary machine connections. Sophomore Year, Electrical Engineering Course. Two lecture periods and three laboratory hours per week.

Electrical Engineering 3

This course deals with the principles and general construction of dynamo-electric machinery systems

of direct current distribution; direct current motors, their action, control and application; the principles and general construction of alternating dynamo electric machinery; systems of alternating current distribution, and alternating current motors. In the laboratory ,practice is acquired in the use of instruments in the operation and testing of direct and alternating current generators, motors and transformers.

First Semester, Junior Year of Electrical Engineering Course, Senior Year of all other courses: Four lecture periods and three laboratory hours per week throughout the semester.

Text Book: Gray, Principles and Practice of Electrical Engineering.

Electrical Engineering 3A

This course is taken parallel with and is intended to be supplementary to Course 3 for Electrical Engineers.

Junior Year, First Semester, Electrical Engineering Course. Two hours per week.

Electrical Engineering 5

Electrical Measurements: Junior Year Electrical Engineering Course. Six laboratory hours per week during the first semester.

Electrial Engineering 8

Alternating Current Laboratory, Junior Year, Second Semester, Electrical Engineering Course: Three laboratory hours per week.

Electrical Engineering 10

Alternating Current Theory: In this course the fundamental principles underlying alternating current calculations are developed. A large number of problems applying these principles are worked out and discussed at length.

Junior Year, Second Semester, Electrical Engineering Course. Four lecture periods per week.

STEAM ENGINEERING

Thermo-Dynamics: This course begins with a

discussion of the theory underlying the operation of heat engines. The theory of the operation of the ideal engine is developed, and the principles governing the actions of steam and gas engines, air compressors and refrigerating machines are fully discussed.

Power Plants: This course applies practically the principles developed under theremodynamics. It embraces the history of the development of the steam engine, and a study of the types in successful use; the application of the indicator and the Prony brake; the study of the steam boiler, and the testing of boilers and fuels. A Thompson indicator, a Prony brake with Fairbanks scales, a Standard Crosby test gauge, and a Carpenter steam separating calorimeter are available for laboratory work.

The school has three boilers aggregating 250 horse-power, and a 40 horse-power Corliss engine; also a gasoline and kerosene engine. This apparatus is also available for laboratory work in this course.

Second Semester. Junior Year for Civil and Electrical Engineering Courses, Senior Year for Mining and Metallurgical Engineering Courses. Three lecture periods per week for the semester and three laboratory hours per week for half a semester.

WIRELESS TELEGRAPHY

The Physics Department is also in charge of the School of Mines Radio Station. This station is completely equipped with the most up to date sending apparatus and two complete receiving sets. One of these is for arc, or continuous waves, and has a guaranteed receiving radius of 9,000 miles The other is for spark, or damped wave, signals. This is intended for shorter range than the other but we have copied messages from all parts of the United States with it.

Effort is made to keep in step with the most recent developments in this relatively new branch of electrical work and new apparatus is being added as needed to keep it up to date.

Chemistry

Professor Hartmann

The courses in Chemistry are designed to give to engineering students the knowledge of chemistry most essential to their work. The subject is given in all courses according to the modern electrolytic dissociation theories. The purpose is to excite in the student an interest in experimentation, to cultivate methods of accuracy and rapidity in manipulation and to teach the proper correlation of the results of experiments.

Chemistry 3-4

General and Elementary Physical Chemistry. This course is designed to give to the student a knowledge of the theories and laws of the science as well as to increase his knowledge of general chemistry facts. Before entering this class the student must have had either Chemistry 1 and 2 (see Preparatory Announcement) or a good high school course in Chemistry. The following subjects are discussed: atoms and molecules, gases, liquids and soldis, solutions, thermo- and electro-chemistry. Special attention is given to the theories of electrolytic dissociation and the law of mass action. The laboratory work in the first semester is designed to show the application of some of the principal generalizations.

Freshman Year. First Semester: Five lecture periods and six laboratory hours per week. Second Semester: One lecture period per week.

Text: W. A. Noyes Text-book of Chemistry

Chemistry 6

Qualitative Analysis: The work in qualitative analysis begins with an outline of the general scheme of analysis. A minute study of the separation and detection of the common acids and bases follows.

Emphasis is placed upon the general principles of chemistry involved, especially the electrolytic dissociation theory and the mass action law. The aim of this course is to teach the student the reasons for every step in the separation and identification of the elements and to develop the idea of quantity as well as quality.

Freshman Year, Second Semester. Two lectures and six laboratory hours per week.

Text Book: A. A. Noyes' Qualitative Chemical Analysis.

Chemistry 7

Advanced Qualitative Analysis. An advanced course to follow Chemistry 6. The methods of analysis of commercial products and minerals are discussed fully. The detection of a number of the rarer elements is also a part of this course. The quantitative idea is emphasized.

Sophomore Year, First Semester Three lectures and six laboratory hours per week.

Chemistry 8

Quantitative Analysis. This course covers the general principles of quantitative analysis and includes the analysis of simple substances by both gravimetric and volumetric methods. The subject of chemical calculations is discussed and problems are solved.

Sophomore Year, Second Semester. Two lecture periods and twelve laboratory hours per week.

Chemistry 9

Metallurgical Chemistry: This course is to familiarize the student with the analytical methods used in conjunction with metallurgical processes. Especial reference is made to the analyses for the rare elements found in the Black Hills region, and to the technical methods connected with the metallurgy of iron, steel, zinc, lead and copper.

Junior Year, First Semester. Metallurgical Engineering Course. Two lecture periods and six laboratory hours per week.

Chemistry 10

Applied Physical Chemistry. This is a brief course to study some of the physico-chemical problems connected with the metallurgical industries.

Junior Year, Second Semester, Metallurgical Engineering Course. Two lecture periods per week.

Chemical Research

Opportunity will be given for original research work along chemical lines to students qualified to undertake such work.

Metallurgy

Professor Crook

Metallurgical subjects are taught by lecture courses with frequent reference to standard works on the subject, and to the current literature.

The lectures are supplemented, as far as possible, by laboratory work and experiments, and by excursions to neighboring metallurgical works. The School is favorably situated in being contiguous to an active gold mining district, the Black Hills, affording execllent opportunity to study the practical side of metallurgy, particularly that of gold, on a large scale and at close range. The stamp mills and cyanide plants of Lawrence county are easily reached by rail in two hours' time.

A well equipped metallurgical laboratory is available for use, and it is desirable that the student should be thoroughly trained in the basic scientific principles of metallurgy. With actual metallurgical operations, on a large scale, the student becomes familiar to such an extent as is desirable during his school years, by visits to the working plants of the district.

In the laboratory he becomes acquainted with the use of pyrometers, calorimeters, microscopes for the examination of metals and furnace products and other scientific metallurgical apparatus. He conducts experiments in the refining and heat treatment of steel, electric deposition of metals, formation of slags, rening of metals, cyanide process and amalgamation, etc. He becomes experienced to some extent with actual working of a furnace, stamp mill, concentrating tables and cyanide plant with which the laboratory is provided.

The department is equipped with a card index of metallurgical literature, which covers all of the

subjects of interest completely, and is at the service of students.

Metallurgy 1

Introductory Metallurgy: This course consists of lectures on the physical properties of metals; on alloys, their types, nature and properties; fuels; combustion; refractory materials, thermal measurements; discussions of metallurgical principles, slags and furnace products and their nature; types of furnaces and furnace construction; the means of supplying and heating blasts; thermo-chemistry, including a discussion of chemistry at high temperatures; typical metallurgical processes and the general economic considerations of metallurgy, such as buying and selling ores and metallurgical products. Students are requested to do outside reading from references given in the class room and hand in for examination papers on topics assigned. Laboratory work covering part of this course is carried out in the Senior Year, and is described under Metallurgy 11.

Junior Year, First Semester: Three lecture hours per week.

Text Book: Hofman, General Metallurgy.

Metallurgy 2

Assaying: This course is taught by lectures and by laboratory work, based on the lectures. Elementary chemistry, qualitative and quantitative analysis are prerequisites, being necessary for a thorough understanding of the work.

The work of the laboratory includes assaying of reagents, the testing of ores to discover their nature; the study of oxidizing and reducing reactions occurring in assaying; the study of typical assay slags; the assaying of pure gold and silver ores by crucible and scorification methods; the special assaying of copper and zinc ores containing gold and silver; the assaying of arsenical and antimonial ores for gold and silver; the study of cupellation and the factors which influence its results; the assaying of impure ores by the roasting, the nitre, and excess litharge methods; the assaying of telluride ores, lead bullion, and cyanide precipitates for gold and silver; the as-

saying of gold and silver bullion; the assaying of ores and alloy for platinum, iridium, etc.; the assaying of lead, tin, bismuth and antimony ores for their respective base metals; the dry assay of mercury ores for mercury; and concentration and free milling tests on a laboratory scale.

Junior Year, Both Options, Second Semester: Two lecture periods and nine laboratory hours per week.

Text Book: Fulton, Manual of Fire Assaying.

Metallurgy 3

The Metallurgy of Gold and Silver: This course consists of lectures on the metallurgy of gold-silver, taking up first, modren stamp mill practice, discussing in detail mortar boxes, stamps, screens, general battery construction, etc., and the influence of weight of stamp, screen mesh, mortar box dimensions, amount of water, on results obtained. Inside and outside amalgamation is studied in detail; the general mill arrangements; clean up; the influences of other proceesses following amalgamation is discussed. Modern fine grinding in tube mills and other apparatus is investigated. This is followed by a discussion of the cyanide process for gold and silver ores; wet and dry crushing; crushing in cyanide solution; the separation of sands from slimes; the treatment of sands by percolation; the treatment of slimes by decantation, filter pressing and vacuum filtration; the precipitation of gold and silver by the various methods in use, methods of cleaning up, and the smelting of cyanide precipitates. The general chemistry of cyanidation is discussed. The chloridizing roasting of silver ores; pan amalgamation; leaching process for silver ores, etc., concludes the course.

Senior Year, Mining Engineering Course, First Semester. Three lecture periods per week. Lecture notes.

Reference works: Julian & Smart, Cyaniding of Gold and Silver Ores; Henry Louis, Handbook of Gold Mining; T. K. Rose, Metallurgy of Gold; Del Mar, Stamp Milling; McFarren, Cyanide Practice; Clennel, The Cyanide Handbook.

Metallurgy 4

Iron and Steel: This course consists of lectures on iron alloys, their classification, structure, properties, metallography; taking up more praticulaly iron and steel. The hardening and tempering of steel is taken up in detail. The metallurgy of cast iron, wrought iron and steel is discussed in principle, but not in great detail. Especial attention is paid to the principles and chemistry of the iron blast furnace and to the Acid Bessemer process, and to the Acid and Basic Open Hearth processes. Statistics of the iron and steel industry are given. The student is required to do considerable outside reading.

Senior Year, both options, Second Semester: Two lecture periods per week. Lecture notes.

Metallurgy 5

The Metallurgy of Copper and Lead: This course consists of lectures on the modern metallurgy of copper and lead. It discusses the types of copper and lead ores and the methods suitable for the treatment of the different types. The principles of the reverberatory process for copper are discussed in detail, as they bring out clearly the chemistry of copper. Matte smelting for copper ores is discussed, both pyrite smelting and ordinary matte smelting being taken up in detail; also the roasting of copper ores. This is followed by the discussion of the Bessemerizing of copper mattes and the electrolytic refining of blister copper. Wet methods for copper ores are discussed. This is followed by a discussion of the blast furnace smelting of lead ores, including the roasting of ores, composition of lead slags, the products of the furnace, etc. The practice of large centrally located plants, treating both mixed lead and copper ores is taken up, also the reverberatory smelting of lead ores, the desilverization of lead bullion, and the refining of lead.

Senior Year, Mining Options, First Semester: Two lecture periods per week.

Reference Works: Hofman, Metallurgy of Lead; Peters, Modern Methods of Copper Smelting; Iles, Lead Smelting; Schnabel, Handbook of Metallurgy; Peters, Principles of Copper Smelting.

Metallurgy 6

Electro-Metallurgy: Electrolytic processes. Theory. Electrolytic processes for copper, gold, silver, lead, nickel and tin.

Eelectrothermic processes. Theory. The electric furnace for iron and steel, ferro alloys, carbides, aluminum, zinc, and for miscellaneous purposes.

Senior Year. Metallurgical Option, Second Semester: Two lecture periods per week.

No text book required. Reference works: Stansfield, The Electric Furnace; Borches, Electric Smelting and Refining.

Metallurgy 7

Gold and Silver: This course is similar to Metallurgy 3 but is given for four lecture periods per week to students taking the Metallurgical Engineering Course.

Senior Year, First Semester.

Metallurgy 8

Metallurgical Calculations: A course based on Richards' Metallurgical Calculations. It is designed to make the student familiar with the more important calculations in connection with the practice of thermochemistry, copper smelting, lead smelting and electrometallurgy.

Metallurgical Option, Senior Year, Second Semester. Two lecture periods per week.

Metallurgy 9

The Metallurgy of Copper and Lead: The same as Metallurgy 5, except that it is amplified by detail.

Senior Year, Metallurgical Option, First Semester: Five lecture periods per week.

Text Book: Peters' Practice of Copper Smelting; Hofman's Metallurgy of Lead.

Metallurgy 10

Metallurgical Design: The design of chimneys, cyanide tanks, stamp cams, zinc boxes, mortar box and block, 5-stamp battery, 10-stamp amalgamating concentrating mill, wood construction, dust chamber, copper blast furnace, copper reverberatory furnace, cyanide plant to treat a given ore; data to be collected from tests in the cyanide laboratory.

Senior Year, Metallurgical Option: Six laboratory hours per week for the second semester.

Metallurgy 11

Metallurgical Laboratory: Laboratory practice in pyrometry; calibration of the thermo-couple with the use of potentiometer; the roasting of ores, noting the formation of sulphate, etc.; the desilverization of base bullion by the Parkes process. Special problems according to the requirements of individual students.

Senior Year, First Semester, Mining Option: Three laboratory hours per week.

Metallurgy 12

Metallurgical Laboratory: One unbroken week spent in the metallurgical laboratory on work assigned by the department.

Senior Year, Both Options, Second Semester: Forty-eight hours.

Metallurgy 13

Metallurgical Laboratory: Course similar to Metallurgy 11, but amplified.

Senior Year, Metallurgical Option, First Semester: Six laboratory hours per week.

Metallurgy 15

Metallurgical Laboratory: Testing of ores for the cyanide process. The student will have thorough training in the testing of ores for the purpose of

VIEWS IN THE METALLURGICAL LABORATORY

ascertaining the best methods of treatment of a given ore. The data obtained will be used in the work in the drafting room in the course in Metallurgical Design.

Senior Year, Metallurgical Option, First Semester: Nine laboratory hours per week.

Metallurgical Research

Research Work: Times and fees by arrangement.

Mining

Professor Bochert

The instruction in Mining is given by lecture courses, illustrated by lantern views, photographs and drawings; by frequent reference to standard works and current literature; by experimental work on various types of ores, carried on in the mining laboratory, and by excursions to nearby mines and mills for the purpose of observing and noting actual conditions of practice.

The department enjoys, to an unusual degree, those advantages which naturally accrue from the school's location. Being contiguous to a world famous mineral region, the nearness of large producing mines means much, while the wholesome mining atmosphere in which the student lives, furnishes a never failing supply of food for enthusiasm and interest.

The mining and metallurgical laboratory of the school, which has proven a most valuable adjunct to the work of instruction, is fully equipped with modern appliances of approved design. The operations attendant upon the preliminary treatment of various types of ore are here carried out by the students on a scale approaching commercial practice.

Special field work in mining is held each year in April. A suitable mining locality having been selected, students under the direction of instructors, devote one week to the study of practical mining, both above and below ground, systematic note taking and careful sketching of all principal features being a requirement. Attendance upon this work is obligatory with all members of the Senior class.

The uniform courtesy and good will shown by the management of mining enterprises throughout the

region to instructors and students indicates a wholesome regard for the efforts of the department and constitutes one of its most valuable assets.

The following courses are offered by the department:

Mining 1

Boring: The use of the earth auger, drive pipe, etc., in the boring of holes for wells and for prospecting purposes; the boring of deep holes by the churn drill and drop tool, also by the diamond and other rotary drills; the survey of bore holes; the cost of boring.

Breaking Ground: The excavation of earth and rock in general; hand tools; mechanical earth excavators; rock drills and their use; channelers; coal cutters, steam shovel; dredges, etc.; estimates and costs.

Explosives: Black powder, nitro-glycerine, gun cotton and their derivaties; methods of testing the force of explosion and heat developed; pointing and charging of holes; methods of firing; cost of blasting operations.

Sophomore Year, First Semester: Three lecture periods per week.

Mining 2

Tunnelling: The driving of mine tunnels and drifts through rocks and through soft or running ground; comparative costs, general discussion of the methods used in driving large tunnels for railroad and other purposes.

, Shaft sinking: The sinking of shafts for mining purposes through soil, rock, quicksand and other water-bearing strata, by approved methods; costs of same.

Sophomore Year, Second Semester: Two lecture periods per week.

Mining 3-4

Ore Dressing: The principles of ore creshing with description of the various types of crushing machinery; screens and the principles of screen siz-

ing; stamp milling and amalgamation; the theory and practical application of the dressing of ores by water currents, including description of the principal forms of classifiers; jigs and the laws of jigging; concentrating tables; slime treatment and the machinery for its accomplishment; magnetic concentration; concentration by oil; dry concentration; general discussion of the continental and English systems of ore dressing and their American modifications; the description and study of typical ore dressing plants.

Junior Year, First Semester: Three lecture periods and three laboratory hours per week.

Second Semester: Two lecture periods per week.

Mining 5

Drainage: Sources of mine water; dams and drainage levels; hoisting of water; Cornish and direct acting pumps; centrifugal pumps; use of compressed air and electricity in pumping operations; special examples and costs.

Transportation: Underground and surface haulage; vehicles and motive power; self-acting and engine planes; tail rope and endless rope systems of haulage; electric and pneumatic haulage; surface tram ways and aerial rope-ways.

Senior Year, First Semester: Two lecture periods per week.

Mining 6

Compressed Air and Its Uses: The modern air compressor with accessories and the laws under which it operates; conveyance of compressed air in pipes; effect of altitude; air compression by the direct action of falling water; calculations; costs.

Senior Year, Second Semester: Two lecture periods per week.

Mining 7

Exploitation: The extraction of mineral by open works, by wells and bore holes; the underground working of veins, bedded deposits and masses by methods best suited to each; conditions affecting the choice of methods; cost of ore extraction.

Supporting Excavations: The use of wood, metal and masonry in the lining of shafts and other excavations, their relative cost, strength and durability; the timbering of stopes, stations and other working places underground; the preservation of timber.

Hoisting: Hoisting engines, their construction and chief features; methods of equalizing the load moment on the engine; ropes, cages, skips and safety appliances; gallows frames, pneumatic hoisting; costs.

Senior Year, First Semester. Three lecture periods per week. Mining Engineering Option.

Mining 8

Ventilation; Natural and induced ventilation; furnaces and fans; friction of air in mines; control of air currents; efficiency of ventilating apparatus.

Lighting: Open lights, safety lamps, the electric and other lights used in underground illumination.

Placer mining: Sluices, riffles, pipe lines, nozzles and hydraulic elevators, their construction and use; river dredging, costs and results.

Senior Year, Second Semester: Three lecture periods per week. Mining Engineering Option.

Mining 9-10

Design of Mining Plant: The student is given certain data relative to an hypothetical mine, such as maximum depth of hoist, capacity of hoisting, etc., from which he calculates the power needed, selects the type and size of hoisting engine, makes calculations as to the size of reel for flat rope, and drums of different forms, such as to give the best results in the equalization of moment on the engine. He then calculates and designs the gallows frame and shaft house, also other features such as ore bin, mine cage, car or skip.

Senior Year, Mining Engineering Option: Six laboratory hours per week throughout the year.

Mining 12

Mining Examination: Sampling of ore bodies,

estimation of "ore in sight" and valuation of mining properties; forms of report.

Administration: Business management and the principles of employment of labor; organization of mine staff.

Mine Accounting: Organization of corporations and stock companies, with particular reference to mining and metallurgical companies; discussion of systems of mine and mill accounting; keeping accounts with different departments; derivation of cost sheets, etc., accounts of smelting and milling plants, yard books, furnace records, ore books, smelting records, etc. General methods of business; buying and selling ores; labor, etc.; organization of the staff of a mining and metallurgical company.

Hygienic Conditions: Surface arrangements for the comfort and convenience of men; ascent and descent by ladders, cage and man engine, and relative economy of different methods; accidents, their causes and prevention; rescue and relief of men; mine fires.

Senior Year, Second Semester; Two lecture periods per week.

Mining 14

Mr. C. L. Lewis

Mining Law: During the year Judge C. L. Lewis will deliver a series of lectures before the members of the Senior class, in which he will discuss and exhaustively review the general mining laws with reference to the public lands, embracing among others, the following topics: The early history of mining prior to the General Laws of Congress; the General Mining Laws of the United States and Territories; Mining Districts, their origin, how organized and the customs, rules and regulations of miners; lands subject to location and who can locate, the proper location of lode claims; the proper location of placer claims; patent proceedings; timber and stone lands in the mining states, and special laws applicable thereto.

Senior Year, Second Semester: One lecture period per week for twelve weeks.

Mathematics

Professor McLaury

The engineer, from the very nature of his work, must of necessity meet many difficult problems. His success will depend on his ability to solve them. As it is impossible to tell in advance just what experience a given student will meet, that course is best which results in mental power. It is not a question of what the student has done, but what he can do. Has he a comprehensive grasp of the subject; has he thoroughly mastered the principles; can he apply these principles to kindred subjects?

The aim of this department will be to give the student a thorough knowledge of the principles of mathematics so as to enable him to apply them readily to the solution of practical problems. Original work is encouraged, and an effort is made to cultivate the habit of exact logical reasoning, and to stimulate independent thought. Both rapidity and accuracy are expected in all mathematical work. The great importance of mathematics as the basis of a scientic education justifies the requirement of all elementary courses, as a prerequisite to the engineering courses.

In the following courses, particular pains will be taken to explain all the more difficult algebraic processes as they occur. Several subjects in higher algebra will be discussed, each at the point where it is required for immediate application. Students who have not studied algebra for a year or more, should make a careful review before entering school, for a thorough knowledge of the elements of algebra is essential to the successful completion of all subsequent courses.

Classes will be provided for students who are deficient in Algebra or Solid Geometry.

Mathematics 7

Trigonometry: Plane, analytical and spherical. Considerable attention is paid to the consistent and scientific development of the fundamental conventions and definitions, and to the derivation and transformation of trigonometric expressions. Many practical problems are solved.

Freshman Year, First Semester: Five lecture periods per week for sixteen weeks.

Text Book: Phillips & Strong's Trigonometry.

Mathematics 8

Analytic Geometry: This course includes the following subjects: Loci; straight lines; transformation of co-ordinates; circles; conic sections; the general equation of the second degree and higher plane curves.

The theory will be developed by lectures.

Freshman Year, Second Semester: Five lecture periods per week for eighteen weeks.

Text Book: Nichol's Analytic Geometry.

Mathematics 9

Differential Calculus: The text book work is supplemented by lectures. This course will include a short course in solid analytic geometry, based on Nichol's Analytic Geometry.

Sophomore Year, First Semester: Five lecture periods per week:

Text Book: Granville, Differential and Integral Calculus.

Mathematics 10

Differential and Integral Calculus: This course is a continuation of the last course and will include the most of the work in Granville's Calculus.

Sophomore Year, Second Semester: Five lecture periods per week.

Mathematics 11

Differential Equations, Junior Year. First Semester, Electrical Engineering Course: Three lecture periods per week.

Text Book: Differential Equations by D. A. Murray.

English

Professor McLearie

The aim of this department is to give the student a command of good idiomatic English and to aid him in the development of the art of expression. Special emphasis is laid upon the importance of good composition in technical work. Attention is called to the absolute necessity that every professional man should be able to express his thoughts with clearness and accuracy.

English 9

The Elements of Effective Writing: This course gives both theoretical and practical instruction. The theory is taught by class room work based on standard text books. The practice is obtained by exercises, written in the class room, and by weekly themes. At least one theme a week is required, and every theme is returned to the student to be revised or rewritten.

Freshman Year, First Semester: Four lecture periods per week.

Text Books: Canby's English Composition; Berkeley's College Course in Writing from Models; Steeves and Ristine's Representative Essays in Modern Thought.

English 10

This course supplements the work of the first semester by giving further practice in narrative, expository and argumentative writing. A study is made of the works of such authors as will aid in practical composition work. Three themes are required, each containing from 800 to 1,000 words. There will be a conference on each theme.

Freshman Year, Second Semester: Four lecture periods per week.

Sociology

This course is introductory in character. It consists of lectures and required readings on the contents and methods of Sociology. The physical, biological and psychological aspects of social evolution will be discussed. As far as possible a number of modern social problems will be considered.

Junior Year, First Semester: Three lecture periods per week.

Economics

This course will give a brief survey of the principles of economics. It will also include discussions of the more important contemporary economic and social problems.

Junior Year, Second Semester: Three lecture periods per week.

Modern Languages

Miss Thomae

This department is open to all students desiring to become acquainted with the scientific knowledge of a language as well as its literary culture. French and German have special importance in the study of all sciences, and the repidly developing trade relations with Central and South American countries have made an increasing demand for Spanish. Courses are offered for two or more years in each language. A rapid and systematic study of the essentials of grammar is emphasized and special attention is given to acquiring facility in conversing.

French 1-2

Elementary French: This course is intended for those who begin French at the School of Mines. Its aim is to enable the student to read ordinary French with ease, to understand to some extent the language when spoken, and to form simple sentences, both oral and written.

Freshman Year, First and Second Semester. Five lecture periods per week.

Texts and Readings: Fraser and Squairs' Grammar; Composition from Francois; Halevy, L'Abbe' Constantin; Hugh, Les Miserables.

French 3-4

Advanced Prose Composition: This course is conducted mainly in French. The work is based up-

on selected texts and drill is also given in the writing of French themes and letters.

Sophomore Year, First and Second Semester. Five lecture periods per week.

Readings: Labiche and Martin, Le Voyage de M. Perrichon; Dumas, La Tulipe Noire.

German 1-2

Elementary German: This course affords practice in pronunciation and in memorizing short selections, and systematic drill in grammar with special reference to syntax.

Freshman Year, First and Second Semester. Five lecture periods per week.

Readings: Gronow, Jung Deutschland; Guerber, Marchen and Erzahlungen; Storm, Immensee.

German 3-4

Advanced Prose Composition: Grammar is reviewed by means of composition and conversation. Prose of advanced nature and literary masterpieces are read and talks in German are given on subjects pertaining to German life. The acquirement of an ability to understand spoken German and the attainment of a practical vocabulary are insisted upon.

Sophomore Year, First and Second Semester. Five lecture periods per week.

Texts and Readings: Vos, Composition; Wildenbruch, Edle Blut; Wells, Drie Kleine Lustspiele; Schiller, Wilhelm Tell.

Spanish 1-2

Elementary Spanish: This course aims to give a knowledge of the essentials of Spanish grammar, the ability to read ordinary Spanish with ease, and some practice in conversation.

First and Second Semester. Five lecture periods per week.

Text and Readings: De Vitis, Spanish Grammar; Roessler and Remy; Geddes, Padre Isla's Lesage's Gil Blair.

Spanish 3-4

Advanced Spanish: Grammar is reviewed by means of composition and conversation. Modern novels and plays are read. This course is a continuation of Spanish 1-2 but more advanced in character.

First and Second Semester. Five lecture periods per week.

Readings: Galdos, Marianela; Hill, Spanish Short Stories.

Biology

Mr. Talbot

All courses in biology are cultural but groups of them give a broad foundation for scientific agriculture, forestry, sanitation, medicine and other biological professions. They are of particular serivce in preparing the student for certain of the geological studies given in the Engineering courses and are open to all students of college rank.

Biology 1

General Biology: This is an introductory course consisting of lectures, conferences and laboratory work. Influence of environment, heredity, variation, structure, life activities, plant and animal organisms in relation to each other, et cetera, are some of the features of the work.

Three lecture periods and two laboratory hours per week for one semester.

Text Book: Sedgwick and Wilson, General Biology.

Biology 2-3

General Botany: The aim of this course is to give the student a general summary of the functions, structure and inter-relations of plants. The first semester is devoted to the lower plants, algae, moss forms, and ferns. In the second semester frequent field trips are taken for the study of seed plants. A number of our early native plants are identified.

First and Second Semester. Three lecture periods and two laboratory hours per week.

Text Book: Atkinson-College Botany.

Biology 4-5

Zoology: In this course, a detailed study of typical representative forms of the main groups is made. Much emphasis is placed upon progressive development, form, structure, activities, life history, heredity and ecology.

First and Second Semester: Three lecture periods and two laboratory hours per week.

Text Books: Hegner's College Zoology, Sigerfoos' Laboratory Manual.

Biology 7

Physiology: Recitations with laboratory study of skeleton, manikin, anatomical models, prepared slides and dissection of domestic animals.

Four lecture periods per week for one semester.

Text Book: Martin's Human Body.

Biology 8

Evolution: The aim of this course is too present to the student the processes of evolution as they are so far understood. Animals and plants serve as illustrative material. Some of the topics considered are species forming heredity, mutation, variation, degeneration, instinct and reason.

One Semester. Three lecture periods per week.

Text Book: Jordan and Kellog's, Evolution and Animal Life.

Shop Work

Mr. Coursen

The aim of this department is to give the student a theoretical knowledge in the class room of the use of tools, with a practical understanding and care of the mechanical equipment in a modern mill.

Shop Work 1-2

Wood Work: The work in the wood shop aims to train the student in the use of wood-working tools and machinery and to familiarize him with the properties of the common woods. Each student is furnished an outfit of bench tools which he is taught to keep sharp and in good condition. The use of simple tools is first learned and this is followed by work on the turning lathe, universal wood-worker, etc. The entire course is bent toward the elimination of awkwardness and to enable the student to command the best use of his hands.

Six laboratory hours per week throughout the year.

Shop Work 3-4

Forge and Machine Shop Work: This course begins with simple exercises in upsetting, bending, twisting, punching, and welding. The work gradually becomes more difficult, such as making eye-bolts, chains, and tongs. Tool-making is then begun by making screw-drivers, hammers and chisels, to be used later in the machine shop. Forging includes the care of blacksmith's fire and tools, the study of forging, tempering, welding, and case hardening. The instructor makes the student familiar with the best grade of steel to be used for any required purpose, and the correct shape and temper necessary for the best work in cutting iron, steel, brass, and stone. The

machine shop work includes molding, casting, use of the oxy-acetylene welding apparatus, the operation of the drill press, lathe, shaper, buffer and hack saw. Practice work in the machine shop concludes this course.

Three laboratory hours per week throughout the year.

Shop Work 5-6

Pattern Making: The work in pattern making requires the construction of patterns for machines, or for parts of machines. Pattern making is studied in its relation to molding; the practical construction of patterns to prevent warping and distortion; the making of special patterns, cores and core boxes, introducing draft shrinkage, finish and the technical appliances and usages of modern pattern work.

Three laboratory hours per week throughout the year.

Shop Work 7-8

Winding Laboratory: This course is designed to be of particular service to students taking the Electrical Engineering Course.

Junior Year: Three laboratory hours per week throughout the year.

List of Students, 1916-17

Senior Class

Cremer, Frank ..... Parkston, S. D.
Price, Virgil T. ..... Rapid City, S. D.

Junior Class

Bentley, Charles ..... Rapid City, S. D.
Clark, Edwin E. ..... Rapid City, S. D.
Johnson, J. Harlan ..... Philadelphia, Pa.
Fredrickson, Arne ..... Nemo, S. D.
McKirahan, Samuel ..... Rapid City, S. D.
Newbowers, Frank ..... Rapid City, S. D.
Stout, Herbert ..... Rapid City, S. D.
Tolton, Fay ..... Fort Bennett, S. D.
White, Luther ..... Dressor, Ill.

Sophomore Class

Behrens, Alfred C. ..... Rapid City, S. D.
Corsen, Helen ..... Rapid City, S. D.
Gantz, Gardner ..... Rapid City, S. D.
Hall, Julius ..... Lead, S. D.
McCain, Galen ..... Rapid City, S. D.
Mallman, Adolph ..... Farmingdale, S. D.
Mara, Hubert ..... Mellette, S. D.
Nelson, Harold ..... Rapid City, S. D.
Wilson, Sidney ..... Deadwood, S. D.

Freshman Class

Brown, Wellington ..... Rapid City, S. D.
Chase, Isaac ..... Rapid City, S. D.
Cook, Lyle ..... Kimball, S. D.
Enos, George ..... Cottonwood, S. D.

Gantz, Frank E. .....Rapid City, S. D.
Harris, Donald .....Highmore, S. D.
Hartwig, Arthur .....Watertown, S. D.
Harvey, William .....Rapid City, S. D.
Hayes, Joel .....Rapid City, S. D.
Hett, Paul .....Lead, S. D.
Hewett, Roswell E. .....Rapid City, S. D.
Johnston, Frank .....Rapid City, S. D.
Johnston, Helen .....Rapid City, S. D.
Jones, Clara .....Rapid City, S. D.
Mechtle, Helen .....Rapid City, S. D.
Perrigo, Harry .....Hermosa, S. D.
Platt, Edward .....Rapid City, S. D.
Parsons, Marie .....Rapid City, S. D.
Parsons, Merle .....Rapid City, S. D.
Prall, Angie .....Rapid City, S. D.
Price, Charles .....Rapid City, S. D.
Schrader, Huston .....Rapid City, S. D.
Stonefielt, Elmar .....Lead, S. D.
Teall, Homer .....Philip, S. D.
Van Meter, Wilmer .....Rapid City, S. D.
Weston, Cora .....Rapid City, S. D.
Wurtsbaugh, C. Guy .....Irwin, Iowa

Special Students

Anstett, J. F. .....Ottumwa, S. D.
Chase, Nellie .....Rapid City, S. D.
Crook, Maud L'Anphere .....Rapid City, S. D.
Diven, Fane .....Rapid City, S. D.
Haft, Della M. .....Rapid City, S. D.
Halley, Lottie .....Rapid City, S. D.
Halley, Russell .....Rapid City, S. D.
Halley, Walter .....Rapid City, S. D.
Hannifan, Margaret .....Rapid City, S. D.
Hughes, Richard .....Rapid City, S. D.
Johnson, Lora .....Rapid City, S. D.
Kheiralla, Anna .....Chicago, Ill.
Lane, Hugh .....Rapid City, S. D.
Leary, Alma .....Rapid City, S. D.
Norman, E. F. .....Rapid City, S. D.
Nystrom, Charles A. .....Rapid City, S. D.
Powers, Marion .....Rapid City, S. D.
Rheinbold, Hugo .....Custer, S. D.

Richardson, George A. .....Mitchell, S. D.
Ronne, Warren .....Rapid City, S. D.
Runner, Jessie .....Rapid City, S. D.
Stone, Gottfried .....Rapid City, S. D.
Taylor, Iva .....Rapid City, S. D.
Watne, Carl A. .....Rapid City, S. D.
Watson, James .....Rapid City, S. D.
Warren, Ruth .....Rapid City, S. D.
Warren, C. C. .....Rapid City, S. D.

Preparatory Students

Bruce, Marion .....Wall, S. D.
Bodenner, Lyle .....Fairburn, S. D.
Bergeson, Arthur .....Wall. S. D.
Bergeson, Ingbald .....Wall, S. D.
Clark, Naoma .....Rapid City, S. D.
Cordes, Richard .....Rapid City, S. D.
Crabtree, Hampton .....Rapid City, S. D.
Crabtree, Verne .....Rapid City, S. D.
Dale, William .....Caputa, S. D.
Dugdale, Ruben .....Silver City, S. D.
Dumont, Glen .....Arp, Mont.
Evans, John .....Piedmont, S. D.
Gano, Alice .....Rapid City, S. D.
Hawley, George .....Interior, S. D.
Hoffman, Ernest .....Keystone, S. D.
Hoy, John .....Keystone, S. D.
Jones, Lawrence .....Caputa, S. D.
Klar, Noel .....Rapid City, S. D.
Kirston, John .....Hamilton, Bermuda
Lorimor, Earl .....Rapid City, S. D.
March, Raymond .....Hill City, S. D.
March, Guy .....Hill City, S. D.
Marsh, Corbin .....Rapid City, S. D.
Mulcahy, Edwin .....Rapid City, S. D.
Napier, Tom .....Rapid City, S. D.
O'Harra, Paul .....Rapid City, S. D.
Platt, Isaac .....Caputa, S. D.
Platt, Chas. .....Caputa, S. D.
Priest, Clarence .....Piedmont, S. D.
Riley, Wilber .....Rapid City, S. D.
Roetzel, Frank .....Custer, S. D.
Sands, William .....Rapid City, S. D.

Sanders, Harley .....Caputa, S. D.
Saxer, Clarence .....Rapid City, S. D.
Saxer, George .....Rapid City, S. D.
Shoemaker, Theodore .....Hermosa, S. D.
Sheldon, Louis .....Belle Fourche, S. D.
Smith, Carroll .....Rapid City, S. D.
Thonstad, John .....Spearfish, S. D.
Westover, Irene .....Fairburn, S. D.
Westover, John .....Fairburn, S. D.
Westover, Maurice .....Fairburn, S. D.
Weeks, Sanford .....Rapid City, S. D.

Alumni

Eighteen Hundred Eighty-Eight

John W. Hancher, B. S., M. S., South Dakota School of Miles; A. M., Mount Union College; LL. D., Simpson College; Associate Secretary of the Board of Education of the Methodist Episcopal Church, 150 Fifth Avenue, New York, N. Y.

Eighteen Hundred Ninety

Carrie Feigel, B. S., Rapid City, S. D.

Benjamin Poznansky, B. S., Western Representative Gerhard-Mennen Chemical Co., Los Angeles, Calif.

Eva Robinson, B. S., A. M., Professor of Home Economics, University of South Dakota, Vermillion, S. D.

Eighteen Hundred Ninety-One

Mrs. Otillie Behrens Alger, B. S. Custer, S. D.

Nineteen Hundred One

G. Howell Clevenger, B. S., E. M., South Dakota School of Mines; A. M., Columbia University; Associate Professor of Metallurgy, Stanford University, California.

Max Hapkins, B. S. One of the Superintendents International Correspondence School of Scranton, Pa. Address, 1415 Majestic Building, Milwaukee, Wis.

Nineteen Hundred Two

Areli C. Overpeck, B. S., E. M. Mining Engineer, Kingman, Ariz.

C. C. Thompson, B. S., E. M. United States Deputy Mineral Surveyor for Nevada, Goldfield, Nev.

Nineteen Hundred Four

Samuel S. Arentz, B. S., E. M. Mining Engineer. Dooly Building, Salt Lake City, Utah.

Arthur E. Hall, B. S., M. E. General Superintendent American Smelting and Refining Co., Omaha, Nebraska.

Elmer W. West, B. S., M. E. Chemist, Thompson, Nevada.

Guy E. Wolcott, B. S. Mining Engineer, Cripple Creek, Colorado.

Nineteen Hundred Five

O. Allen Anderson, B. S., E. M. Superintendent, August Mining Co., Landusky, Montana.

James Halley, Jr., B. S. Cashier Keystone Bank, Keystone, S. D.

Hollis W. Overpeck, B. S., E. M. Mine Superintendent, Oliver Iron Mining Co., Buhl, Minn.

Nineteen Hundred Six

Edwin Coolidge, B. S., E. M. Leasing Spotted Horse Mine, Maiden, Mont.

Harry T. Curran, B. S., E. M. Superintendent Argo Reduction Co., Idaho Springs, Colorado.

William Gains, B. S. Mill Superintendent, Beaver Creek Mining Co., Dodson, Montana.

B. D. O'Brien, E. E. Rose Polytechnic, 1896; B. S., E. M., South Dakota School of Mines. Sundance, Wyo.

Louis L. Penhoel, B. S. 524 Wesley Roberts Building, Los Angeles, Calif.

J. Burns Read, B. S., E. M. Assistant Professor of Metallurgy, Case School of Applied Science, Cleveland, Ohio.

Herbert Seiter, B. S. Merchant, Albion, Nebr.

Earl Van L. Smith, B. S. Akron, Ohio.

Peter Whytock, B. S. Mining Engineer,, Pasadena, Calif.

Frederick H. Wetherald, B. S., M. E. 39 Eldom Street, Dorchester, Mass

Nineteen Hundred Seven

Frank Anderson, B. S. Engineer, Bisbee, Arizona.

Frank Bryant, B. S., E. M. Maiden, Mont.

Wharton Cornell, B. S., 1711 Rodney St., Wilmington, Del.

Otto Ellerman, B. S., E. M. State Mine Inspector, Lead, S. D.

Bernard Matson, B. S., U. S. Assay Office, New York, N. Y.

Lloyd Mellinger, B. S. Assayer and Chemist, Martinez, California.

Milton Morris, B. S. Ray Consolidated Copper Co., Ray, Ariz.

C. C. Van Nuys, A. B., Yankton College; B. S., E. M., South Dakota School of Mines; A. M., Columbia University. Professor of Physics, Colorado School of Mines, Golden, Colo.

Charles Whitemore, B. S. Hardware Merchant, Canton, S .D.

Leon Peck Wells, B. S. Vice-president Aberdeen Wholesale Grocery Co., Aberdeen, S. D.

Nineteen Hundred Eight

Cyril Coolidge, B. S. Mining Engineer, Tyrone, New Mexico.

Ivan E. Goodner, B. S. Mining Engineer, Paradise, California.

L. L. Hebblethwaite, B. S., Evanston, Ill.

Glen P. Ives, B. S., E. M. General Manager, Compani de Minas, Cachiral, Taltal, Chile.

Lem S. Overpeck, B. S. With Frazier and Johnson Commission Co., South Omaha, Nebraska.

Ignacio Diaz Ossa, B. S. President, School of Mines of Serena, La Serena, Chile.

W. G. Sparling, B. S. Rapid City, S. D.

D. C. Woodard, B. S. Assayer and Metallurgist, La Serena, Chile.

Fred W. Winters, B. S., E. M. Lake City, Minn.

Nineteen Hundred Nine

Jesse O. Betterton, B. S., M. E. Chemist American Smelting and Refining Co., Omaha, Nebraska.

Roy F. Coolidge, B. S., E. M. Chemist American

Smelting and Refining Co., 7528 Coles Avenue, Chicago, Ill.

Eli A. Hvistendahl, A. B., University of South Dakota; B. S., South Dakota School of Mines. Chemist American Smelting and Refining Co., Omaha, Neb.

H. W. Jones, A. B., University of South Dakota; B. S., South Dakota School of Mines. Farmer, Rapid City, S. D.

Lewis W. Ledyard, B. S. Mining Engineer, Teck-Hughes Gold Mines, Kirkland Lake, Ontario.

Willard C. Marshall, B. S. With Warren Lamb Lumber Co., Rapid City, S. D.

Herbert N. Read, B. S., E. M. Mill Superintendent Socorro Mining Co., Mogollon, New Mexico.

Nineteen Hundred Ten

Richard T. Bennett, B. S. Electrician, Minneapolis, Minn.

John Wasson Eddy, B. S. Helena, Montana.

John Wing Elliott, B. S., Manager Columbus Auto Company, Columbus, Neb.

George Earl Flower, B. S., Constructing Engineer, Cleveland Water Filtration Station, Cleveland, Ohio. Address 1436 W. 110th St.

Zay Jeffries, B. S., M. E. Assistant Professor in Metallury, Case School of Applied Science, Cleveland, O.

Arthur E. Sargeant, B. S. Mill Superintendent, Mogul Mine, Terry, S. D.

John William Stoner, B. S. City Engineer, Lead, S. D.

Joseph H. Saville, B. S., E. M. Foreman, Anaconda Copper Co., Anaconda, Mont.

Harry Ellis Wheelock, B. S. General Manager, Socorro Mining Co., Mogollon, New Mexico.

Nineteen Hundred Eleven

William L. Anderson, B. S., M. E., Mining Engineer, Rochester, Nevada.

Floyd Brooks, B. S. Mining Engineer, Sudbury District, Worthington, Ontario.

Chester G. Ehle, B. S. Water Engineer, City Hall, Portland, Oregon.

Fred J. Muhmel, B. S. Scotland, S. D.

Elwin H. Quinney, B. S., M. E. Assistant State Engineer, Pierre, S. D.

Frank H. Winsor, B. S. Mitchell, S. D.

Clarence G. Willard, B. S., M. E. Mill Superintendent, Golden Reward Mining Co., Terry, S. D.

Nineteen Hundred Twelve

Samuel C. Dickey, B. S. With Oro Hondo Mining Co., Lead, S. D.

Frank A. Fahrenwald, B. S., E. M., South Dakota School of Mines; M. S., Pennsylvania State College; Ph. D., University of Michigan. Consulting Metallurgist. Address Case School of Applied Science, Cleveland, Ohio.

Peter Mosier, B. S. Assistant Superintendent Mary Murphy Mining Co., Romley, Colorado.

Nineteen Hundred Thirteen

Alfred Alder, Jr., B. S. Metallurgical Chemist, Buenos Ayres, Argentina.

Amil A. Anderson, B. S. Assistant Metallurgist, Homestake Mine, Lead, S. D.

J. M. Hartgering, B. S. With Clarence W. Hubbell, Consulting Engineer, Detroit, Mich.

Hugh M. Henton, B. S. Instructor in Metallurgy, Case School of Applied Science, Cleveland, Ohio.

Nineteen Hundred Fourteen

W. C. Bochert, B. S. Professor of Mining, South Dakota School of Mines, Rapid City, South Dakota.

Robert B. Eldridge, B. S. Ray Copper Co., Ray, Ariz.

Arthur W. Fahrenwald, B. S. Professor of Mining and Metallurgy, New Mexico School of Mines, Socorro, New Mexico.

Lloyd L. Farnham, B. S. Superintendent Home Lode Mine, Silver City, S. D.

Leo Fleischman, B. S. Mine Superintendent, Rowena, Colorado.

Robert S. Hill, B. S. Diamond Prospector, care For-

miniere Mission, Kasai, Tshikapa, Congo, Belge. Via Boma and Luebo.

Willard J. McCauley, B. S., Aberdeen, S. D.

R. O. Meents, B. S. Mining Engineer, Miami, Ariz.

W. Cristy Pryer, B. S. In Testing Laboratory Anaconda Copper Co., Anaconda, Mont.

George E. Stowell, B. S. Professor of Geology and Mineralogy, Oregon Agricultural College, Corvallis, Oregon.

Nineteen Hundred Fifteen

Lionel E. Booth, B. S. In Testing Laboratory Anaconda Copper Co., Anaconda, Mont.

Clyde E. Gates, B. S. High School Teacher, Minto, N. D.

B. Marvel O'Harra, B. S. Chemist American Smelting and Refining Co., Omaha, Neb.

Arthur Thiel, B. S. In Testing Laboratory Anaconda Copper Co., Anaconda, Montana.

Nineteen Hundred Sixteen

Cragin, Rodney, B. S. American Tin & Tungsten Co., Hill City, S. D.

Dennis, Paul, B. S. Socorro Mining Co., Mogollon, New Mexico.

Hill, Joseph , H., B. S. Ray Consolidated Copper Co., Ray, Ariz.

Smith, Elwyn, B. S. St. Louis Mo.

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ERRATA.

An error was made in that the name of Clarence Leslie Lewis, Lecturer on Mining Law, should appear at the top of page six, instead of at the bottom of page 5.

87 So H
1917/18

South Dakota State School of Mines

ANNUAL CATALOG
1917-1918

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With Announcements for 1918-1919

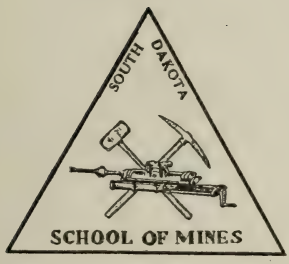
RAPID CITY, SOUTH DAKOTA
APRIL 1918

THE SCHOOL OF MINES "M"
112½ feet by 67 feet

THE GATEWAY, SCHOOL OF MINES CANYON, IN THE BIG BADLANDS

South Dakota State School of Mines

ANNUAL CATALOG
1917-1918



With Announcements for 1918-1919

RAPID CITY, SOUTH DAKOTA
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COLLEGE CALENDAR.

1918.

Sept. 17, Tuesday.....Registration.
Sept. 18, Wednesday....First Semester begins
Nov. 28, Thursday.....Thanksgiving Recess begins.
Dec. 23 Monday.....Christmas Vacation begins.

1919.

Jan. 4, Saturday.....Christmas Vacation ends.
Jan. 27 to Feb. 1.....Midyear Examinations
Feb. 1, Saturday.....First Semester ends.
Feb. 3, Monday.....Second Semester begins.
Feb. 22, Saturday.....Washington's Birthday.
March 31 to April 5.....Annual Field Trips.
May 25, Sunday.....Baccalaureate Sermon.
May 26, Monday.....Final Examinations begin.
May 28, Wednesday.....Commencement and Conferring of Degrees.
May 29, Thursday.....Final Examinations end.

REGENTS OF EDUCATION.

Members of the Board.

THEODORE W. DWIGHT, Sioux Falls,
Term expires January 1, 1921.

THOMAS D. POTWIN, Lemmon,
Term expires January 1, 1923.

AUGUST FRIEBERG, Beresford,
Term expires January 1, 1919.

FRANK ANDERSON, Webster,
Term expires January 1, 1919.

J. W. CAMPBELL, Huron,
Term expires January 1, 1921.

Officers of the Board.

THEODORE W. DWIGHT, President, Sioux Falls.

IRWIN D. ALDRICH, Secretary, Big Stone City.

G. H. HELGERSON (State Treasurer), Treasurer Ex-Officio.

Regents Committee in Charge of the School of Mines.

THOMAS D. POTWIN FRANK ANDERSON

FACULTY OF THE SCHOOL OF MINES.

CLEOPHAS CISNEY O'HARRA
President and Professor of Geology
A. B., Carthage College; Ph. D., Johns Hopkins University

HOWARD LINCOLN McLAURY
Professor of Mathematics
A. B., Oberlin College; A. M., Harvard University

JOHN McLEARIE
Professor of English
A. B., Macalester College; A. M., University of Chicago

JOSEPH JAMES RUNNER
Professor of Mineralogy and Petrography
A. B., University of Nebraska

MINER LOUIS HARTMANN
Professor of Chemistry
B. S., University of Arizona; Ph. D., Harvard University

CHARLES LEE SWISHER
Professor of Physics
A. B., University of Illinois; A. M., University of Michigan;
Ph. D., Cornell University

WILLIAM CHARLES BOCHERT
Professor of Mining
B. S., E. M., South Dakota State School of Mines

FRANK WEISS TRAPHAGEN
Professor of Metallurgy
Ph. D., Columbia University

JOHN FREDERIC MANGOLD
Professor of Civil Engineering
B. E., C. E., State University of Iowa

CLARENCE LESLIE LEWIS
Lecturer on Mining Law
University of Michigan

HUGH W. TALBOT
Associate Professor of Biology
B. S., Colgate University

BERTHA THOMAE
Instructor in Modern Languages and History
B. A., Mississippi State College

WILLIAM A. COURSEN
Superinendent of Buildings and Grounds and Instructor in
Machine Shop

DELLA MAY HAFT
Librarian
Ph. B., University of Chicago

ANNA LEWIS
Registrar and Secretary to the President

CHARLES BENTLEY
In Charge of Mining Experiment Station Work

Student Assistants

EDWIN CLARK, Physics.
HUBERT MARA, Physics.
GEORGE ENOS, Chemistry.
R. JULIUS HALL, Chemistry.
HARRY DEUTSCH, Metallurgy.
WILLIAM WALDSCHMIDT, Geological Museum.

In Charge of Student Activities

A. J. SCHIEFERSTEIN, Director of Orchestra.
NELLE SEARLS, Director of Glee Club.
FRED GUSHURST, Football Coach.
WILLIAM BUBBERS, Basketball Coach.

Other Employes

MRS. A. O. ANDERSON, Janitor.
FRANK BOYD, Fireman.

STANDING COMMITTEES OF THE FACULTY

ADMISSION AND REGISTRATION

Charles L. Swisher
Howard L. McLaury
John McLearie
John F. Mangold

EMERGENCIES

Howard L. McLaury
William C. Bochert
Miner L. Hartmann
John McLearie
John F. Mangold
Joseph J. Runner
Charles L. Swisher
Frank W. Traphagen

STUDENT WELFARE

William C. Bochert
Bertha Thomae

THESES AND DEGREES

Miner L. Hartmann
William C. Bochert
Charles L. Swisher
Frank W. Traphagen

ATHLETICS

William C. Bochert
Howard L. McLaury
John McLearie

SCHOOL MAGAZINE

John McLearie
William C. Bochert
Miner L. Hartmann
John F. Mangold
Frank W. Traphagen

CATALOG

Joseph J. Runner
Howard L. McLaury
Hugh Talbot

LIBRARY

Hugh Talbot
Della M. Haft
Joseph J. Runner
Frank W Traphagen
Bertha Thomae

BOARD OF CONTROL OF THE ATHLETIC ASSOCIATION

John MsLearie
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R. Julius Hall, '19.
Sidney Wilson, '19

Howard L. McLaury, Secretary of the Faculty

The regular meeting of the Faculty is held on the first Friday of each month at 3:45 p. m.

GENERAL STATEMENT

Establishment of the School

The School of Mines is a state educational institution, and is at the present almost wholly maintained by appropriations of the State Legislature. It is endowed with 40,000 acres of South Dakota land, a grant from the federal government. It receives a comparatively small income from the rental of these lands which are, however, steadily increasing in value. The school is under the direction of the Regents of Education. The regents, five in number, are appointed by the governor, confirmed by the senate and have control of the various public institutions of learning maintained wholly, or in part, by the state as state institutions.

The following is an extract from the act of the Legislature, establishing the School of Mines:

Section 1. (School of Mines Established.) That a School of Mines for the Territory of Dakota be established at Rapid City, in Pennington County, Dakota Territory. It shall be the object of such School of Mines to furnish facilities for the education of such persons as may desire special instruction in Chemistry, Metallurgy, Mineralogy, Geology, Mining, Milling, Engineering, Mathematics, Mechanics, Drawing, the Fundamental Laws of the United States and the Rights and Duties of Citizens.

Approved March 7, 1885.

History and Aim of the School

The chief aim of the State School of Mines is to offer young men a thorough education in mining and metallurgical engineering, believing that thereby the exploitation of the mineral resources of the state will be aided. Whenever it is possible, the school also aids the development of the mineral resources of the state by the investigation of mining and metallurgical problems which arise. At the present time many graduates of the School are employed in responsible positions in the lack Hills and throughout the West generally, and the institution is doing much toward the development of the state's mineral wealth. It is

well known that the successful exploitation of the Cambrian ores of the Black Hills has been due in a large measure to the experiments performed at the State School of Mines. This refers particularly to chlorination, to sulphide smelting and to cyanidation.

Demonstration of the possibilities of artesian wells in the western part of the state has been largely due to the work of this school, together with that of the United States Geological Survey.

The School issues from time to time, bulletins treating of Black Hills geology, and of mining and metallurgical methods. A list of the bulletins is given on a subsequent page. They may be obtained by those interested upon request.

The first building of the School was erected in 1885. It is a three-story brick structure costing approximately $12,000, in which were originally, chemical and assay laboratories, and class rooms. The staff of instructors was necessarily small and the course by no means complete. The school, however, under able management, gained in reputation, and, in 1887, erected a second building to serve the purpose of a metallurgical laboratory. This building, costing nearly $30,000, is 138 feet by 60 feet in size, and was fitted with metallurgical and mining experimental machinery. In 1901, the front portion of what is now the Main Building of the school was erected, the legislature appropriating $20,000 for that purpose. In 1903 $18,000 was appropriated by the legislature for a rear addition and $5,000 was appropriated for the construction of a separate heating plant. In 1905, $8,000 was appropriated for the improvement of the metallurgical laboratory, and extension of the heating plant; in 1907, $15,000 for additions to the metallurgical laboratory, and in 1909, $8,000 for further extension of heating plant and improvements to the metallurgical laboratory.

In 1911 the legislature appropriated $5,000 for repairs to the reparatory Building, $2,500 for replacements in the heating plant, $2,000 for an electric generator and $800 for new cement sidewalks.

The number of buildings and equipment at the present time is such as to give good facilities for thorough instruction in mining and metallurgy and allied subjects.

Location.

The School of Mines is located at Rapid City in the foothills of the Black Hills of South Dakota. The Black Hills region is the gem of the central northwest. Perhaps no area of equal extent in America more fittingly represents a well-selected group of community interests. By geographic position, topographic configuration, natural resources and commercial facilities it is the controlling magnet of a great area for industry, trade and recreation.

Structurally, the region is an elliptical outwardly-dipping uplift, the more distinct features of which show a maximum extent of about 150 miles in length and 80 miles in width. The longer axis approximately coincides with the meridian except in the northern portion, where the general direction is to the northwest. Each rock unit, with its particular and sometimes striking color, yields distinctive topographic forms, the result being that in many places features of rare interest are produced. The Harney Peak area of the southern Hills, with its bold pinnacles and shoulders of coarse, bare granite, rising from their forest-clad base of metamorphosed sedimentary rocks, presents a beautiful landscape, while the steep-walled canons of Spearfish creek, Rapid creek and Elk creek in the Northern Hills are among the most picturesque that America can show. Again to the northwest along the upper Belle Fourche valley, where the nearly horizontal sandstones and shales have been intricately carved by the various streams and where the brilliant and varied colors of the several formations harmoniously blend with a wealth of forest and pasture overlooked here and there by the stately, somber forms of porphyry buttes, there is presented a view well worth many a hardship to see.

The climatic conditions of the Black Hills proper are scarcely excelled anywhere in the United

States. The rainfall is not heavy, but is generally sufficient and the chief precipitation comes during the planting and growing season when most needed. Aside from this, clear, mild days prevail through much of the year. Extreme cold and extreme heat are exceptional and of short duration.

The mining interests of the Hills are of paramount importance, but large industries, particularly forestry, agriculture, horticulture, stock raising and manufacturing share in the fundamental occupations of the people. The mineral products are gold, silver, lead, copper, iron, tin, tungsten, mica, spodumene, amblygonite, fullers earth, volcanic ash, and structural materials, including clay, cement ingredients, and building stones. The mineral production since he first mining in 1875 is approximately $250,000,000.

In addition to the natural features of the region, the political, social, educational and moral status of the people is commendable to a marked degree. Few new countries show a greater percentage of cultured men and women interested in the healthy advancement of a whole region and in the all-round development of every individual. Communication with all parts of the Hills is facilitated by excellent wagon roads, and railroads are convenient to every important district. The main lines connecting with other parts of the country are the Chicago and Northwestern railway, the Chicago, Burlington and Quincy railway, and the Chicago, Milwaukee and St. Paul railway. Rapid City is on the line of the Chicago and Northwestern connecting with Omaha, also on the line of the same road connecting with the eastern part of the state, through Pierre, and on the Chicago, Milwaukee and St. Paul connecting with the eastern part of the state through Chamberlain. It has also connection with the Burlington system by means of the Rapid City, Black Hills and Western railway from Rapid City to Mystic.

Rapid City is a growing city of about 5,000 inhabitants. It was founded in 1876 and is the most beautifully located city in the Black Hills. It is situated on Rapid creek 3,200 feet above sea level, and

a half hour's walk takes one either out on the plains or into the hills. It offers many advantages as a college and residence city. There are seven churches, a hospital, a fine new opera house, four banks, a United States land office and weather bureau, wholesale and retail mercantile establishments, various manufacturing enterprises, many rooming houses, good hotels and enterprising newspapers. The city has also an excellent system of water works fed by springs four miles back in the hills; a modern illuminating gas works, a sewer system, and a hydro-electric plant furnishing light and power.

The people of Rapid City are interested in the welfare of the school and in addition to the usual social advantages of the place, opportunity is not infrequently given the students living elsewhere to enjoy the pleasures and influences of the best homes of the city. An additional feature of interest is that all students room and board in the homes as the school does not maintain a dormitory.

The distance to the chief gold mining districts of the northern Hills near Deadwood and Lead is less than fifty miles. The mining districts of the central Hills west and southwest of Rapid City are still nearer. This gives the student convenient access to active mining operations whenever desired and at the same time prevents undue distraction liable to result were the school in the midst of the hurry and hustle of mines and mills.

A particularly helpful feature, the value of which cannot well be overestimated. is the opportunity the students have for working in the many mines and mills of the Hills during the summer vacations. This work following the year's schooling not only surpasses the ordinary summer mining course in the gaining of practical information, but to the energetic student, is also a source of ready cash.

Electrical Engineering and Civil Engineering Courses.

The School of Mines has from the early days of its organization maintained classes in various branches of Civil Engineering and for a considerable

number of years it has done the same in Electrical Engineering. The laboratory and field equipment necessary for the giving of proper instruction in these engineering studies has grown in proportion to the needs of the institution and now serves to give extended courses in these subjects. The Regents of Education have authorized the school to outline its course of study to the effect that students taking work to receive degrees already in vogue, should have the option of majoring in either Electrical or Civil Engineering. In conformity with this authorization a four years' course in Electrical Engineering and a four years' course in Civil Engineering have been outlined and these courses are now offered. In the purchase of apparatus for teaching these engineering courses efficiency has been the guiding feature and the apparatus is the best obtainable.

The varied development in the Black Hills region during the past several years has added emphasis to this work and to the urgent need for strengthening these courses. In Civil Engineering there is road making, bridge building, railroad construction, mine surveying, irrigation work and the various phases of mining and municipal problems. In Electrical Engineering there are particularly the hydro electric and the steam electric plants for the generating of light and power for mines and metallurgical plants, manufactories and municipalities, Five hydro electric plants on as many different mountain streams of the Black Hills and costing morethan two and a half million dollars serve to indicate the present trend of activity and to indicate the latent possibilities of our swifter streams. Several thermo electric plants are also in operation.

Buildings and Grounds.

The buildings in which the work of the School is carried on are four in number: First the original School of Mines building, a commodious brick structure, three stories in height, situated in the west part of the grounds, and at the present time de-

voted to modern languages and preparatory science, in which students found deficient in studies for entrance into the School of Mines are properly prepared. It contains a large assembly or study room and class rooms for the study of languages, mathematics, and history, a laboratory for biology, and a new and well equipped woodshop. It is heated throughout by steam from the central power plant and is lighted by electricity. This building has recently been extensively repaired and remodeled throughout and is now modern and well adapted to its purpose.

In the center of the grounds is the Main Building of the school, a large, brick structure, with native sandstone trimmings, three stories in height, built in two wings. This building contains, in the front wing on the first floor, a large entrance hall, the President's and Registrar's offices, lecture rooms for Mathematics and English, and the Geological Museum; also, in the rear, the Library and the Department of Geology and Mineralogy, consisting of lecture room, office, map and mineralogical store rooms, and a thoroughly equipped mineralogical laboratory. On the second floor are the Department of Chemistry and the Department of Civil Engineering. The chemical laboratories comprise the general, qualitative and quantitative laboratories, with balance room, supply rooms, lecture room and office, together with a private laboratory for the professor in charge. The rooms for the Department of Civil Engineering consist of instructor's office, two large drawing rooms, a lecture room, supply rooms and a room equipped for making blue prints. In the basement are the physical laboratory, store rooms, a locker room, lavatories, a special experimental room, an engine room with a gasoline engine, and a machine shop The machine shop enables the School to make a very appreciable amount of apparatus for scientific work as the occasion for its construction arises.

East of the Main Building is the Metallurgical Laboratory Building, 138 feet by 60 feet in plan, two stories high, built of red brick covered with

stucco. This building is devoted exclusively to the Departments of Mining and Metallurgy, and to the work of the State Mining Experiment Station. It contains, on the first floor, a large laboratory for advanced metallurgical chemistry, a well equipped balance room, containing massive concrete piers for the mounting of balances, chemical laboratory and supply room, assay laboratory and a large assay furnace room. In the rear of the assay furnace room is the metallurgical machinery and apparatus and storage bins for ore and fuel. On the second floor are the lecture rooms of the Departments of Mining and Metallurgy, offices of these departments, and the mining and metallurgical museum.

On the east part of the school grounds is located the central heating plant, containing an aggregate of 250 horse-power of boilers which supply heat for the three large buildings mentioned above, and power for the metallurgical and other laboratories by means of two 35 K. W. steam turbines connected to direct current generators. A third turbine unit similar to the above, but of seven K. W. is available for experimental work, and a three-panel switch board supplies connections. This building is built of stone and has adjoining sheds with a large capacity for the storage of coal. There is also in the boiler house a blacksmith shop for instruction in forge work.

Equipment.

In general, the school is well equipped to carry on its work. It has the essential of modern scientific technical instruction, ample laboratory facilities in all required branches.

Library.

The library occupies a large, well lighted and well equipped room on the first floor of the Main Building. It is made up of more than six thousand volumes and includes encyclopedias, standard works on Metallurgy, Mining, Geology, Chemistry, Engineering, Physics, Biology, Mathematics, English, History, Sociology, Economics and many works of a general nature.

Many authoritative, scientific and technical journals published by the leading societies and organizations of the United States and foreign countries are found on the reading tables and the library has complete files of most of these. Monthly periodical indexes make the material of these journals available for ready reference.

The library is a repository of the documents of the United States Geological Survey, many of the state geological surveys and surveys of some of the foreign countries.

The Dewey system of classification is used and a card index gives author, title and subject.

All students have direct access to the shelves and are thus able to make the best possible use of the library. Books commonly consulted for reference may not be removed from the room but others by special arrangement may be withdrawn for a period of two weeks.. The privileges of the library are extended to those not attending the institution. Arrangement for these should be made through the librarian.

Drawing Rooms.

In the Department of Engineering are two large drawing rooms—one for Freshman work, the other for Sophomore and Junior work.

The rooms are well lighted and fitted with especially designed drawing desks, each desk containing lockers in which students take care of their supplies. Adjoining the Freshman drawing room is a large room for the making of blue prints. It contains the blue print machine, sliding on a frame in the window, with south exposure so that sunlight is available for the greater part of the day. Sinks for washing blue, brown and brick prints are provided.

Chemical Laboratories.

There are four chemical laboratories in the Main Building—one for general chemistry, one for qualitative analysis, one for quantitative analysis, and a special laboratory for fuel and water analysis. The quantitative and qualitative laboratories are

equipped with large individual desks with tile tops, each desk being supplied with gas from the city mains. Between the desks are sinks with flowing water. The laboratories are also supplied with compressed air and with apparatus for suction. Each student receives a separate and complete set of reagent bottles and supplies. The laboratories are well lighted and provided with ample hoods to carry off fumes. The quantitative laboratory is equipped with a separate weighing room in which are analytical balances of standard makes. In addition to these laboratories there is a private laboratory for the professor of chemistry, a special dark room for spectroscopy, a dark room to be fitted for photochemistry, and two supply rooms from which the students get their apparatus and chemicals as needed.

The laboratories have recently been overhauled and the woodwork and desks refinished. The hoods have also been rearranged in order to get better ventilation and new ones have been installed.

The apparatus is ample for all mineral, alloy and rock analysis, as well as for research along certain lines. The special apparatus includes combustion furnaces, apparatus for gas analysis, facilities for electro-chemistry, calorimeters for fuel analysis, spectroscopes for qualitative experiments, and electroscopes for determination of radium and uranium in waters, gases, and minerals.

Biological Laboratory.

This laboratory is equipped with high class apparatus and materials. Compound and simple microscopes are provided the student for the study of forms, structures, interrelation of parts and functions and camera lucidas and a projectionscope allow for the execution of careful drawings. Several hundred thin sections of animal and plant forms are available for study and three kinds of microtomes are for use in making sections. There are also excellent anatomical models of one or more forms of the principal groups of animals, a number of imported charts showing growth habits, skeletons, in-

cluding that of the human, bacterial apparatus, and a large aquarium with living forms for the study of habits, interdependence of organisms and the relation of organisms to their surroundings.

Physical Laboratory.

The Physical Laboratory is located in the basement of the Main Building. It has a cement floor and the tables are on cement pillars, thus securing stable foundations for such apparatus and instruments as require them. The laboratory is well equipped for accurate experimental work. Among the more important pieces of apparatus are precision balances, air pumps, acceleration apparatus and Atwood machine; a variety of apparatus for specific gravity, including hydrometers, Jolly balances, Westphal balances, etc., large Steinheil spectroscope, large vernier spectrometer, precision apparatus for complete measurements in interference, diffraction, polarization and dispersion of light; apparatus for sound measurements; complete equipment for determinations of specific heat, heat of combustion, heat of vaporization, etc., complete apparatus for the determination of the mechanical equivalent of heat, seconds clock with electrical attachment; barometers, precision thermometers and pyrometers, air thermometer, Beckman thermometers; and a complete line of instruments for electrical measurements, including Weston voltmeters, ammeters and wattmeters for a variety of ranges, Weston and Paul alternating current voltmeters and ammeters, Leeds and Northrup potentiometer, Leeds and Northrup precision wheatstone bridge, Kohlrausch bridge, standard condensers, Siemens electrodynamometers, Braun hot wire meters, Nalder Bros. standard inductance, Weston, Leeds & Northrup, and Cambridge Scientific Instrument Co.'s galvanometers, Braun electrometers, Dolezalek quadrant electrometer, aluminum and gold leaf electrometers and electroscopes, magnetometers, voltmeters, standard resistances; also completely equipped switch boards for both high and low voltage distribution of direct or one, two or

three phase alternating current, and many special pieces of electrical apparatus, as Tesla transformers, induction coils, X-ray apparatus, spark and arc spectrum apparatus; a variety of dynamos, motors, motor-generator set, induction machines, gasoline engines and models of steam and gas engines.

The School also possesses a compleely equipped wireless telegraph station consisting of a sending set of one KW capacity and sensitive receiving sets for long distance messages. Among the larger pieces of apparatus is a Westinghouse 10 K. W. rotary converter designed for many different kinds of experimental work and embodying in itself the features of a number of different electrical dynamo machines. It is designed to be operated upon either alternating or direct current and will act as a generator or as a motor. When using alternating current its operation may be one, two, or three phase. Complete switchboard equipment is provided for its control in any one of its many modes of operation and includes a complete set of high grade measuring instruments for both alternating and direct current measurements. These include ammeters, voltmeters, wattmeters, power factor meters, frequency meters and dial synchroscope, all mounted on white marble panels which also carry the A. C. and D. C. circuit breakers, switches, plugs, etc. These switchboards also control a General Electric Company's 15 H. P. three phase induction motor with phase wound motor and drum control for variable speed service. This machine may be connected to the rotary converter above described by a link belt silent chain for full load tests on either machine. The equipment also includes a one K. W. motor generator set consisting of a single phase induction motor and a shunt wound generator. There are also a number of smaller A. C. and D. C. motors of various types. In addition to the above, the School heating and lighting plant and the equipment of the Departments of Mining and Metallurgy afford the student opportunity for making tests on dynamos and motors, engines and turbines of com-

mercial sizes. The laboratory is well equipped with tools and work benches for the construction of special pieces of apparatus.

Apparatus for Civil Engineering.

The School of Mines is well equipped with surveying instruments for all kinds of plane surveying. It possesses one Gurley Y level, one Dietzgen Y level, one Berger Dumpy level, one Bausch and Lomb precision level, two Gurley transits, one with solar attachment, one Keuffel and Esser transit with Saegmuller solar attachment, one Dietzgen transit with auxiliary mining telescope, one Ainsworth transit with auxiliary mining telescope, one Bausch and Lomb mining transit, one Keuffel and Esser plane table, one Keuffel and Esser sextant, one clinometer, one planimeter, together with complete equipments of stadia rods, leveling rods, range poles, feild glasses, tapes, chains, axes, etc. The topography of the lands near the school offers excellent opportunity for all kinds of field work, with every degree of difficulty from flat prairie to the most rugged of rough hill country.

A Riehle cement testing machine is available for testing cement briquettes.

Assay Laboratory.

The assay laboratory is modern in its appointments. It contains a room in which the students are provided with individual desks, pulp balances for the mixing of assay charges; a balance room provided with concrete foundation piers; the pulp room in whch the ore samples, etc., are crushed and sampled, and the furnace room in which furnace work is done exclusively. This furnace room contains two gasoline assay furnaces and five double muffle-furnaces, heated by soft coal. These are placed in openings in a heavy dividing wall, separating the machinery hall from the front part of the building. In this way the front of the furnaces with the muffle openings are in the furnace room, flush with the wall, while the firing and taking out of the ashes is done on the other side of the wall, thus avoiding the dust and dirt in the main work room.

The furnace room is fireproof. There is a melting furnace using coke, and gasoline furnaces, made by Braun & Company, San Francisco. Large gas furnaces are available for experimental work, such as roasting, smelting, annealing, etc.

The balance room is provided with Ainsworth, Eimer & Amend, Thompson, and Keller balances. In the pulp room an electric motor furnishes power for the small Gates sample crusher and a sample grinder. A Calkins automatic cupel machine is used for making cupels. A large number of ore samples are kept on hand. Ores from all parts of this country are provided in great variety. The nearness of smelters and mills makes it comparatively easy to procure many types of furnace products, such as mattes, flue dust, fume, and umpire sample for close checking work.

Mining and Metallurgical Laboratories.

There are two metallurgical laboratories in the Metallurgical Building; one in which are conducted metallurgical experiments as outlined in Metallurgy 11 and 13, and the other in which the various metallurgical processes are performed on a commercial scale.

The experimental laboratory is equipped with individual desks provided with gas and air; analytical and pulp balances, hot plates, and water sinks; a complete cyanide plant of ten pounds capacity, consisting of a Trojan ball mill, high pressure blower, a Pachuca agitator and filter press· a Braun cyanide plant, a Hendryx mechanical agitator; gas and electric furnaces, pyrometers, potentiometers and platinum resistance, pyrometer, Parr and Mahler-bomb calorimeters, electrcal measuring instruments, etc.

The commercial laboratory is designed to illustrate chiefly the metallurgy or gold, silver, copper and lead. It is best adapted to handle ore in quantities of from three to five tons, but larger quantities may be treated if necessary.

The crushing machinery consists of a No. O Gates breaker, a pair of 16x10 inch rigid rolls, a

6x4 inch Bosworth jaw crusher, a 10x4 ft. Alsing tube mill, a 3½ ft. Huntington mill and a 3-300 lb. stamp battery and amalgamating plates.

The cyanide plant consists of two 5x3 ft. sand tanks, two 5x5 ft. slime tanks; two 4x3½ ft. solution storage tanks; two 4x3½ ft. gold solution tanks and two zinc boxes. For the agitation of slime a 10x2½ ft. Pachuca tank is used, while for slime thickening and filtration a 5 ft. Callow cone and small Moore vacuum filter are employed. The accessory apparatus for cyanidation consists of four 1½ inch centrifugal pumps, a vacuum pump, an air compressor and receiver, and three electric motors for power, etc. The above plant is extremely flexible, so that any variation from an all-sand to an all-slime process can be demonstrated on a commercial scale.

The ore dressing apparatus consists of a Traylor table, a Frue Vanner, two classifying cones, an impact screen, a Vezin sampler, and a Jarvis experimental jig.

The present oil flotation apparatus consists of a complete Callow laboratory machine, a modified Hoover machine, and a slide machine. Important additions are contemplated for the coming year.

The smelting machinery consists of a 30-inch blast furnace which may be used for either lead or copper smelting, forehearths, slag cars, and other accessories; a small Bruckner roasting furnace, and a Green rotary blower. The crushing and cyaniding and concentrating machinery is so placed that any combination of apparatus desirable may be secured and practically every possible system of treatment worked out.

Metallographic Laboratory.

This laboratory is equipped with four metallographic microscopes, microphotographic apparatus, polishing machines, etc., and much pyrometer apparatus, of various kinds, including potentiometer, resistance boxes, etc. Electric furnaces are provided for heat experiments and for metallography.

Mineralogical Laboratory.

This is a large room well equipped with low tables arranged for study and determination of minerals. Students are provided with the necessary reagents and apparatus, by the department. Each student has his own locker. A large working collection of carefully labeled minerals available for students' use is kept in specially designed cases ready of access, and a considerable collection of unknown minerals is at hand for determination.

Geological Museum.

This museum is an important feature in the equipment of the School of Mines. Its contents have been chosen to assist in the teaching of geology, mineralogy, petrography, and paleontology, rather than to become a storehouse of curiosities. The room has a floor area of thirty-six by forty-seven feet, is twelve feet high, and is lighted by ten large windows.

Two kinds of cases are used for the display of specimens—central cases and wall cases. There are eight central cases of oak, each consisting of two parts of three compartments each, with glazed tops, and a six compartment massive base; the whole constructed in such a manner as to serve practically as two sections, fitting tightly back to back. The display surface, under glass, is nearly fifty square feet for each case. The bases are especially designed for the storage of material not needed for constant exhibition.

The wall cases are finished in pine and have glazed doors. Each is seven feet six inches high and contains three double door compartments of six shelves. The cases are particularly adapted for the display of large specimens.

Cases one and two and four contain a general collection of minerals arranged according to Dana's system of classification. Case three contains a series of specimens to illustrate general features of mineralogy, geology and petrography. Case seven contains a collection of well preserved fossils, carefully selected to show the more prominent features of paleontological interest. Cases five and six con-

tain representative collections of Black Hills ores and rocks. Case eight contains Cretaceous and Tertiary fossils from the Black Hills region, mainly from the Cheyenne river and the White river Badlands.

The wall cases are for large specimens of all classes, some of which are very beautiful. The collection from the Black Hills is especially noteworthy and is very rich in rare minerals of the region, as for instance, lepidolite, wolframite, columbite, amblygonite, etc.

The museum contains two large relief maps of the Black Hills made for the St. Louis exposition, also a very valuable and unique ore section of the Homestake mine, donated by the Homestake Mining Company, of Lead, South Dakota. Many framed maps of mines and important geological regions adorn the walls and serve as an added educational feature of the room.

The collection of minerals exhibited by the school at the St. Louis Exposition, 1904, received a diploma and gold medal, as did also the Black Hills relief maps.

Mining and Metallurgical Museum.

This is situated on the second floor of the Metallurgical Building, in a large, well lighted room and contains wall cases for the display of specimens. It has a fair collection of furnace products, such as slags, mattes, alloys, fuels, refractory materials, and wall boards and hoisting ropes and screens, safety lamps and models of head frames and similar materials. In time it will become a valuable adjunct to the teaching of mining and metallurgical subjects. It is constantly being added to by the kindness of manufacturers and mining companies, who donate exhibits. The school is always very grateful for donations of this kind and makes due acknowledgment for the same. New cases for the display of these things have recently been provided.

Shops.

In the basement of the Main Building a small machine shop is provided containing a machine lathe, shaper, drill press, other machinery and many tools. Occasion often arises for repairs and for design and construction of certain pieces of apparatus for different departments, especially those of Metallurgy, Mining, Physics and Chemistry.

Many pieces of apparatus have been constructed in this shop which would have cost the school considerable sums of money. The students of the upper classes are granted permission to use the facilities afforded by the shop, whenever occasion arises to do so in their work.

A blacksmith shop, equipped with forges, anvils and tools, is located in the building containing the power and heating plant.

To provide manual training in the preparatory department, a wood shop has been installed in the Preparatory Building. This shop contains one motor-driven variable speed wood lathe, one 8-inch universal wood worker and complete sets of carpenter tools and benches.

Publications.

The school publishes at irregular intervals bulletins of greater or less length on subjects covered by its various lines of activity. These may be obtained free of cost by persons interested so long as there are copies in stock. Eleven have been published. They are as follows:

Bulletin No. 1—Preliminary Report of the Dakota School of Mines upon the Geology, Mineral Resources and Mills of the Black Hills of Dakota; 171 pages. 1888. By F. R. Carpenter and H. O. Hofman. **(Out of Print.)**

Bulletin No. 2—Notes on the Geology and Mineral Deposits of a Portion of the Southern Black Hills; 41 pages, 1899. By C. C. O'Harra and A. Forsyth.

Bulletin No. 3—Cyanide Experiments on the Silicous Ores of the Northern Black Hills, etc.; 27 pages. 1900. By A. Forsyth and G. H. Clevenger.

Bulletin No. 4—Two papers: A History of the Early Explorations, and of the Progress of Geological Investigation in the Black Hills Region; and A Bibliography of Contributions to the Geology and Geography of the Black Hills Region; 88 pages. 1900. Bq C. C. O'Harra. **(Out of Print.)**

Bulletin No. 5—The Cyanide Process in the Black Hills of South Dakota; 88 pages. 1902. By C. H. Fulton. **(Out of Print.)**

Bulletin No. 6—The Mineral Wealth of the Black Hills; 88 pages. 1902. By C. C. O'Harra. **(Out of Print.)**

Bulletin No. 7—Metallurgical Practice in the Black Hills of South Dakota; 63 pages. 1904. By C. H. Fulton.

Bulletin No. 8—The Cement Resources of the Black Hills; 55 pages. 1908. By C. C. O'Harra, M. F. Coolbaugh, M. A. Ehle Jr., and C. H. Fulton.

Bulletin No. 9—The Badland Formations of the Black Hills Region; 152 pages. 1910. By C. C. O'Harra. **(Out of Print.)**

Bulletin No. 10—The Minerals of the Black Hills; 200 pages. 1914. By Victor Zeigler.

Bulletin No. 11—A Bibliography of the Geology and Mining Interests of the Black Hills Region; 225 pages. 1917. By C. C. O'Harra.

The Pahasapa Quarterly

This is a magazine published by the faculty and students of the institution. As the name indicates, it appears four times during the school year and is devoted to the interests of the School of Mines and of the Black Hills region. It contains articles of interest to engineers generally and to the students and alumni of the School of Mines especially. The subscription price is one dollar per year.

STUDENTS' EXPENSES

Tuition

The tuiton and incidental fee is $6 per semester, or $12 per year, **payable in advance on registration.** This fee is the same to residents and non-residents of the state.

According to Section 209 of the Political Code, 1903, page 40:

"The regents shall fix all rates of tuition and other fees, to be paid by students, but such rates shall be the same in all the different institutions. They may receive, in any one of the institutions under their control, free of tuition, two students, appointed by each State Senator and one by each Representative of the State Legislature, which appointees shall be residents of their respective districts or counties, and whose term shall expire with the term of office of said senator or representative, provided that such appointees shall comply with all the rules and requirements of the institution which they desire to enter. No student, however, shall receive any other gratuity whatever."

Fees and Deposits

The fees named below cover only the cost of materials and supplies necessarily consumed in the laboratory courses mentioned. All fees and deposits must be paid on registration at the beginning of each semester.

Chemistry 3, General Chemistry	$ 5.00
Chemistry 6, Qualitative Analysis	5.00
Chemistry 7, Qualitative Analysis	5.00
Chemistry 8, Quantitative Analysis	6.00
Chemistry 9, Metallurgical Analysis	6.00
Metallurgy 11-13, Metallurgical Laboratory	5.00
Metallurgy 15, Cyanide Testing	5.00
Metallurgy 2, Assaying	5.00
Students' Activities Fee, required of all regularly enrolled students, per semester	3.00
Fee for bachelor's degree	5.00
Fee for advanced degree	10.00
Fee for permit for "conditioned" examination	2.00

The deposits named below are made to cover the cost of breakage and extra supplies used in the courses named. The unused portion of each deposit will be returned to the student at the end of each semester.

Civil Engineering, deposit	$ 5.00
Metallurgy 15, Cyanide Testing, deposit	10.00

Metallurgy 2, Assaying, deposit 20.00
General breakage deposit for engineering students taking laboratory courses in Chemistry or Metallurgy 5.00
No platinum is furnished by the Department of Chemistry.

Other Expenses of the Nature of Fees

The Department of Engineering furnishes supplies for the mechanical drawing courses, practically at cost.

Engineering 1-2, Mechanical Drawing, will cost approximately $5.00 for the year, exclusive of drawing instruments, which the student purchases on his own account, prices ranging from $12.00 up for a good set of instruments.

Engineering 3-4, Descriptive Geometry, will cost approximately $2.00 for the year.

Engineering 7, Topographic Drawing and Engineering 9, Machine Design, will cost $2.00 for the year.

Living Expenses

Board and room may be obtained in town with private families or in boarding houses or hotels, at rates varying from $20 to $30 per month, according to accommodations; $25 per month is a fair average and will insure good board and room. Rooms only may be obtained for from $5 to $10 per month, and table board for from $5.00 upwards per week. This makes the expense for board and room for the school year of 35 weeks range from $160 to $275, according to location and accommodations.

Expense of laundry and incidentals vary with the individual. The average for laundry expenses is about $20 for the school year.

Approximate Cost of Text Books

Freshman year $13.00
Sophomore year 17.00
Junior year 20.00
Senior year 19.00

Total cost, including living, fees, books, incidental expenses, etc.
Freshman year .....$280 to $380

Sophomore year	275 to 370
Junior year	320 to 430
Senior year	290 to 385

This estimate does not include expenses incurred outside of school. A certain sum for this purpose should be added, according to individual taste.

Incidental Expenses

Students are required, at various times, to take part in the geological, mining and metallurgical trips undertaken into the Black Hills mining district. The geological trip of the Freshman year usually costs the student about $10. The surveying trip in the Sophomore year will cost about $12. Trips in the Junior and Senior year, for mining and metallurgical exploration, cost a similar sum; so that the student should figure on a cost of from $30 to $40 at least, for expenses of this kind during his four years' course at the school.

Opportunities for Self Help

Opportunity for self help in a town of the size of Rapid City is necessarily limited. It is also to be borne in mind that the course of study is an arduous one and requires the student's best effort, and if conscientiously and satisfactorily performed, will leave comparatively little outside time in which to earn money.

Some students find employment which nets them their board and lodging by doing chores in private families or assisting in some of the stores. Some find employment in the boarding houses. The school is able to assist a few students, to some extent, by employing them in the capacity of assistant janitors and similar work.

Students who have become acquanted, by a residence in town for a year or two, find it easier to obtain work than strangers. For this reason it is essential that a student who comes as a stranger to enter the school should be provided with sufficient funds to carry him through the first year, at the very least.

SCHOOL ACTIVITIES

The School of Mines encourages student activities. Athletics have long been an important feature of the student life and in recent years considerable attention has been given to other forms of recreation and improvement. The following organizations may be mentioned:

Athletic Association—The Athletic Association has for its aim the furtherance of legitimate athletics, and maintains football, baseball and basket ball teams and track athletics. It is governed by a Board of Control made up of three members of the faculty, three students selected from the Sophomore, Junior and Senior classes respectively, and one Alumni member. The association maintains baseball, football and tennis grounds. The school heartily encourages athletics within the proper limits. The Students' Activities Fee gives access to athletic grounds and pays for admission to games and for subscription to the Pahasapa Quarterly.

Orchestra and Glee Club—The Orchestra and Glee Club, each of which is under the direction of a trained musician were organized to accommodate such students as are musically inclined. The institution owns a good Knabe piano and this is available for use. There is no special charge to the student for instruction, his activity fee covering all costs.

Engineer Corps—During the past year the students of the institution wishing to be of service in the movement for preparedness organized a military company. Drills are given two hours each week and there are occasional talks on the duties of engineer troops. The purpose of the organization is to afford favorable opportunity for the study of some of the fundamentals of military science.

Conduct.

The school has no codified rules of conduct. Students are held to a strict account of work and are expected to fulfill their inheritance as gentlemen. Failure to live up to the requirements is considered a sufficient cause for severing their connection with the school.

MINING EXPERIMENT STATION.

The School of Mines aims to assist the prospector and mining man in every reasonable way in determining the nature and value of such rocks, minerals, and ores as he may have. For many years members of the institution have given a considerable part of their services to the determination of minerals and rocks and to the assaying and analyzing of samples sent in for determination. A large amount of experimental work has been done in order to learn the most economic methods of extracting values from ores. Recently the state has appropriated a special amount of money for the enlargement of this work, and every effort will be made to make the service available to all people of South Dakota who may be interested. Assays for gold and silver are made for twenty-five cents per sample. Many qualitative analyses are made free and quantitative analyses are made at as low rates as possible. Prices will be sent upon application. All samples for analysis or assay and letters accompanying the same may be addressed to the School of Mines Experiment Station.

REQUIREMENTS FOR ADMISSION.

Freshman Class.

Requirements for admission to the Freshman class are as follows:

Fifteen units are necessary for entrance.

Required Units.

Algebra	1.5 units
Plane Geometry	1 unit
Solid Geometry	0.5 unit
English	3 units
History	1 unit
Physics	1 unit
Chemistry	1 units
Total required units	9 units

Elective Units.

French	1, 2 or 3	units
German	1, 2 or 3	units
Latin	2, 3 or 4	units
Greek	1	unit
Spanish	1 or 2	units
English	1 or 2	units
History	1 or 2	units
Algebra	0.5	unit
Science	1 or 2	units
Drawing	1	unit
Shop Work	1	unit
Civil Government	0.5	unit
Bookkeeping	1	unit
Elective units required for entrance	7	units

A unit course of study is defined as a course covering a school year of not less than 35 weeks with 5 periods of at least 45 minutes each per week.

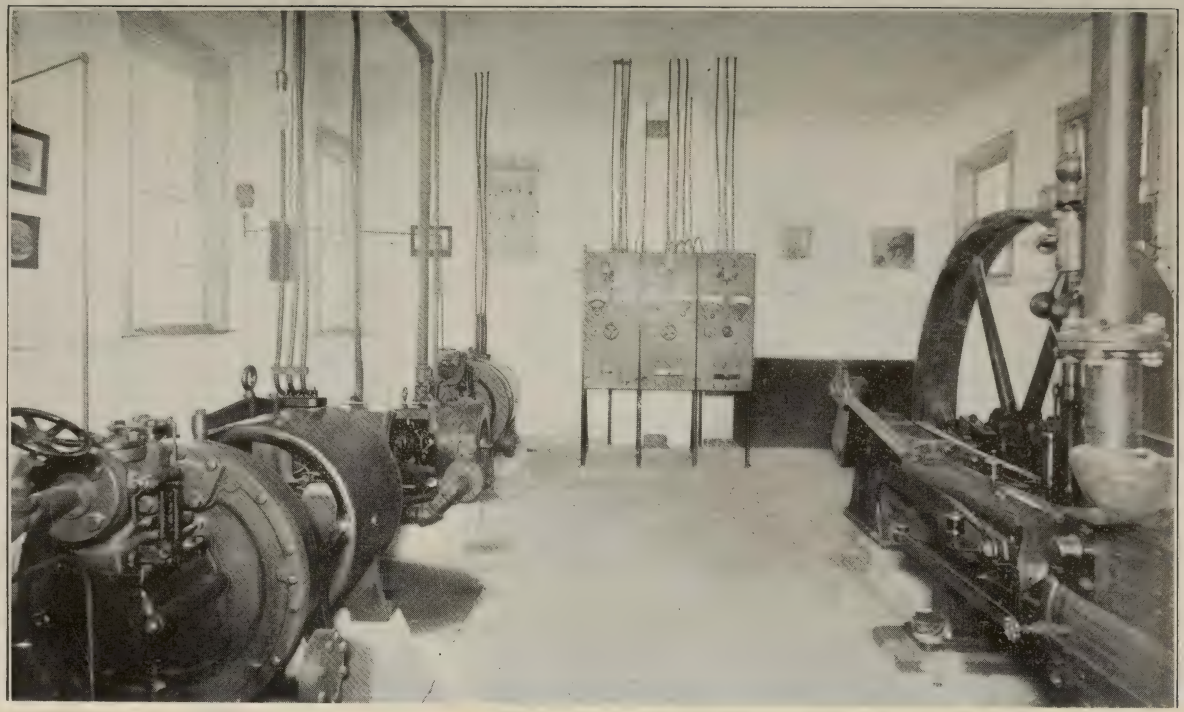
Methods of Entering the School.

Graduates of accredited High Schools in the state of South Dakota and other states will be provisionally admitted without examination, if they present proper credentials, certifying to the fact that they have completed the studies mentioned under the requirements for admission.

Other candidates for admission will be given credit for so many of the fifteen required units as they may bring credits for, and will be permitted to make up the remainder in the Preparatory Department of the School of Mines, which is maintained for the special purpose of preparing students found deficient in entrance requirements.

Credentials for entrance should be in the hands of the President on or before the date set in the calendar for the examination of credentials by the committee on admission.

Application for admission blanks will be sent upon request.



DESCRIPTION OF UNITS REQUIRED FOR ENTRANCE.

Required Units.

Mathematics: The three units which may be offered in mathematics are as follows:

Algebra—One and one-half units. The equivalent of A, B and C Algebra described under Preparatory Mathematics in the Preparatory Announcement.

Plane Geometry—One unit. The equivalent of plane geometry described under Preparatory Mathematics.

Solid Geometry—One-half unit. The equivalent of solid geometry described under Preparatory Mathematics.

English—Three units. The equivalent of English 1-2 and 3-4 described under Preparatory English and other courses described in that department.

Physics—One unit. The equivalent of physics described under Preparatory Physics in the Preparatory Announcement.

Chemistry—One unit. The equivalent of elementary chemistry described in the Preparatory Announcement.

History—One unit. The History of the United States, English, Ancient or Modern History as described under History in the Preparatory Announcement.

Elective Units.

The equivalent of courses, not mentioned above, described under Languages, History, English and Preparatory Science, in the Preparatory Announcement.

Special Students.

Applicants for admission, who are graduates of colleges or technical schools wll be admitted as special students and permitted to take any subject they desire, taught in connection with the regular courses. Persons of mature age, who have been employed in

mines and metallurgical plants and who desire to take up special courses particularly along the lines of mining, metallurgy and geology, will be admitted as special students, provided they show that they have sufficient foundation to take up the work with profit to themselves. No immature person will be permitted to enter the school to take advanced courses, such as Assaying, Metallurgy, etc.

GENERAL STUDIES.

The South Dakota School of Mines is frequently approached by students, both men and women, who have no ambition to become engineers but who seek to enlarge their mental horizon by taking some of the subjects of more geenral interest offered in the engineering and preparatory courses. To all such persons the School of Mines extends a cordial welcome and offers every facility at its disposal for their fultural benefit. The attention of persons so minded is called to the following list of subjects, all taken from the regular courses, which have a general educational value: English literature, foreign languages—including French, German and Spanish —history, sociology, economics, mathematics, biology, geology, mineralogy, chemistry, physics, astronomy, drawing. From these subjects a course may easily be selected corresponding to the first two years of a general college curriculum. Every effort will be made to give satisfactory attention to special students taking work along any of these lines. The only fees charged are the usual tuition and students' activities fees and such laboratory fees as may be required in courses taken.

Summer School.

The summer school in surveying begins immediately after commencement and occurs between the sophomore and junior years. The electrical engineers spend two weeks in plane surveying, the mining and metallurgical engineering students spend two weeks in plane surveying and one week in under-

ground mining surveying, and the students in civil engineering spend six weeks in surveying as outlined in the civil engineering course. Every effort is exerted to make this work practical and instructive. The mining surveying is done in a suitable mine in the Black Hills, the remainder of the work is done in the vicinity of Rapid City.

Preparatory Department.

The School of Mines finds it necessary to maintain a Preparatory Science Course on account of certain sections of the state being without adequate High School facilities. Students from these portions of the commonwealth frequently enter the School of Mines deficient in entrance requirements. It is mainly for their sake that the school maintains this department.

The School of Mines faculty has direct supervision of the work. Two instructors devote their entire time to the department and several of the professors teach one or more subjects. The same laboratory facilities are afforded preparatory students as are enjoyed by the higher classes.

The tuition and incidental fee is $12 per year or $6 per semester.

A special announcement describing the Preparatory Science Course is published and will be sent on application.

Admission to Advanced Standing.

Graduates of college and technical schools who enter the school as candidates for a degree will receive proper credit for all such studies which they have completed and which form part of the curriculum of the School of Mines. The faculty decide these cases upon the basis of individual merit.

Degrees.

The School of Mines offers wo degrees: That of Bachelor of Science in Mining Engineering, to the candidate who has successfully completed the regular Mining Engineering Course, and that of Bachelor of

Science in Metallurgical Engineering, to the candidate who has completed successfully the Metallurgical Engineering Course.

The degree of Engineer of Mines, or of Metallurgical Engineer, will be conferred upon graduates of the corresponding engineering course of the school, who shall have devoted one year at graduate study in the School of Mines, under the direction of the faculty, passing required examinations upon the studies pursued, or to those who shall furnish evidence of two years successful experience in mining or metallurgical work, and who shall submit an adequate thesis which shall be duly considered and accepted by the faculty before such advanced degree will be granted.

Candidates for the engineer's degree should make application for such not later than December first of the school year in which graduate work is begun.

In order to allow time for correspondence and corrections, the thesis of a non-resident candidate should be submitted not later than April 15th of the year in which the degree is to be granted.

If the completed thesis is approved by the head of the department concerned, he shall transmit it to the committee on advanced degrees with his approval in writing.

A true and perfect copy of the corrected and approved thesis must be filed with the librarian not later than the 20th of May.

Students who complete the studies in the Preparatory Department will receive a certificate to that effect.

Thesis.

Every candidate for a degree in either engineering course is required to present a thesis on some subject patent to his course before he will receive his degree.

At the beginning of the school year the individual members of the senior class are expected to consult with the thesis committee of the faculty regarding the subjects for their thesis. Preference will be

given to subjects selected by the student, provided they meet the approval of the committee. Students unable to select subjects for themselves will be assigned subjects by the committee.

Report of progress in thesis work must be made at stated intervals to the thesis committee. Thesis must be submitted to the faculty not later than May 15th, and must be typewritten on paper 8½x11 inches in size. Two copies must be furnished; one for the department within which the thesis falls, and one for the library. No degree will be granted unless the conditions concerning thesis are fully satisfied.

The following is a list of the some of the theses submitted:

Arentz, S. S. Some Experiments on Bromo-Cyanogen.

Hall, Arthur E. Some Features Illustrating the Quantitative Chemistry of the National Smelter Blast Furnaces.

West, Elmer W. Notes on Assay Slags.

Anderson, O. A. The Grand View Mining Property with Plan and Estimated Cost of Development Work and Reduction Plant.

Coolidge, E. B., and Gaines, Wm. N. The Metallurgical Treatment of Ore from the Queen Bee Property.

Curran, H. T. and O'Brien, B. D. Experiments on the Blue Ores of the Black Hills.

Read, John B. The Distribution of Gold and Silver in the Siliceous Ores of the Black Hills.

Seiter, Herbert, and Penhoel, L. C. Some Suggestions Relative to the Development of the Grand View Mining Property Near Silver City.

Smith, E. V. L. Development of a Low Grade Mining Property, Kittilas County, Washington.

Wetherald, Fred H. The Determination of Formation Temperatures of Certain Silicates.

Whytock, Peter R. Preliminary Notes on Some Supposed Nickeliferous Minerals of the Black Hills.

Bryant, Frank. An Investigation of the Different Cyanide Methods, as Applied to the Treatment of the Black Hills "Blue" Ores.

Ellerman, Otto. The Gordelia Mining Company of Rochford, South Dakota.

Matson, B. V., and Anderson, F. B. Report on the Hematite and Delaware Mines, Including Metallurgical Treatment.

Morris, Milton, and Cornell, W. L. Experiments on Slag Losses Due to Borax Glass.

Van Nuys, C. C. Plane Curves.

Wells, L. P., and Whitmore, C. F. Report on Coolgarde Group of Claims, Ida Gray Mining District.

Coolidge, Cyril, and Overpeck, Lem S. The Iron Deposits of the Black Hills of South Dakota.

Goodner, Ivan E. (With Professor C. H. Fulton.) The Constitution of Copper-Iron and Copper-Lead-Iron Mattes.

Ives, Glen P., and Ossa, Ignatio D. Metallurgical Treatment of Jamesonite Ores.

Sparling, Wm., and Winters, F. W. A Hypothetical Mine.

Betterton, J. O. The Determination and Separation of Antimony and Arsenic.

Coolidge, Roy F. The White Precipitates Found in Zinc Boxes.

Jones. H. W., Hvistendahl, E. S. and Read, H. N. The Standby Mine.

Ledyard, L. W. The Cleopatra Mine.

Eddy, John W., and Bennett, R. T. A Hypothetical Mine.

Jeffries, Zay, and Wheelock, H. E. Economic Resources of the Badlands.

Sargent, A. E., and Flower, G. E. The Development of a Hypothetical Mine and the Metallurgical Treatment of the Ore.

Saville, Joseph H. The Possible Development of the Deep Down Property and Treatment of Its Ore.

Stoner, J. W., and Elliott, J. W. A Hypothetical Mine.

Anderson, Wm. L. Investigation of White Precipitate in Zimmerman-Reinhart Method for Iron.

Brooks, Floyd R. Investigation Concerning the Melting Points of a Series of Copper Slags.

Ehle, Chester G. Gypsum Deposits and the Stucco Industry in the Black Hills.

Quinney, E. H., and Winsor, F. H. Jr. Cyanide Tests on a Refractory Siliceous Ore of the Northern Black Hills.

Willard, C. C., and Muhmel, F. J. Investigations of Fire Clays Near Rapid City.

Fahrenwald, Frank A. Report on the Rapid Valley Irrigation Project.

Anderson, Amil A. On the Cambrian Blue Siliceous Ores of the Black Hills.

Alder, Alfred. Experiments with the Quantitative Analysis of Lead.

Hartgering, J. M. Design of a Cement Plant.

Henton, Hugh M. Some Experiments in Analysis of Titanium, Magnesium, Zinc.

Bochert, W. C. Metallurgical Treatment of a Typical Refractory Siliceous Ore.

Eldridge, Robert B. Experiments in Ore Flotation.

Fahrenwald, Arthur W. Report on the Metallurgical Investigation of a Blue Ore.

Farnham, Lloyd L. Experiments on the Fine Grinding and Amalgamation of Jamesonite Ores.

Fleischman, Leo. Data on the Relative Fuel Consumption of Oil and Coal Fired Muffle Furnaces.

Hill, Robert S. Notes on Beryllium.

McCauley, Williard J. An Investigation of the Irrigation Possibilities of Little Elk Creek.

Meents, R. O. Leaching a Copper Ore.

Pryer, W. C. Investigation for a Volumetric Determination for Arsenic.

Stowell, George E. The Geology of Silver City and Vicinity.

Booth, L. E., and Thiel, Arthur. Electrolysis of Alkaline Solutions of Potassium Sulpho-cyanide.

Gates, C. E. The Design of a Plant for a Southeastern Missouri Lead Mine.

O'Harra, B. M. The Gold-Bearing Quartz-Tremolite Series of the Black Hills.

Cragin, Rodney S. Tests for Gold and Silver of the Country Rock of the Black Hills.

Dennis, Paul Joseph. Experiments in Making Brick from the Graneros and Pierre Shales.

Hill, Joseph Henry. The Refining and Recovery of Gold from Dental Scrap.
Smith, Elwyn L. Radio-active Minerals of the Black Hills.
Anderson, Amil. Homestake Stamp Mill Parctice.
Bochert, Wm. C., and Price, Virgil T. Flotation of a Gold-Bearing Schist Ore.
Cremer, Frank. Burnt Gumbo and Its Adaptability for Improving the Highways of South Dakota.

COURSES AND DEPARTMENTS.

All engineering courses offered by the School of Mines require four years for completion. They are as follows: Mining, Engineering, Metallurgical Engineering, Civil Engineering, and Electrical Engineering.

SYNOPSIS OF COURSES.

MINING ENGINEERING COURSE.

First Year.

	Hours per Week.	
First Semester—	Lectures.	Lab.
Mathematics 7—Trigonometry	5	
Chemistry 3—General	4	6
Geology 1—General	4	3
English 9—Composition	4	
Civil Engin. 2—Mechanical Drawing		6
	17	15
Second Semester—	Lectures.	Lab.
Mathematics 8—Analytic Geometry	5	
Chemistry 4-6—General and Qualitative	4	6
Geology 2—General	4	3
English 10—Composition	4	
Civil Engin. 2—Mechanical Drawing		6
	17	15

Second Year.

First Semester—	Hours per Week. Lectures.	Lab.
Mathematics 9—Calculus	5	
Chemistry 7—Qualitative	3	6
Mineralogy 1—General	2	3
Civil Engin. 3—Descriptive Geometry	1	3
Civil Engin. 5—Surveying	2	6
Mining 1—Breaking ground	3	
	16	18

Second Semester—	Lectures.	Lab.
Mathematics 10—Calculus	5	
Chemistry 8—Quantitative	2	12
Mineralogy 2—Blow-pipe	2	6
Civil Engin. 6—Surveying	3	3
Mining 2—Tunneling, shaft sinking	2	
	14	21

Summer surveying three weeks.

Third Year.

First Semester—	Hours per Week. Lectures.	Lab.
Physics 3—General	3	3
Physics 5—Analytic mechanics	4	
Geology 3—Petrology	3	4½
Civil Engin. 7—Topographic drawing.		1½
Civil Engin. 9—Machine design		6
Metallurgy 1—General	3	
Mining 3—Ore dressing	3	3
	16	18

Second Semester—	Lectures.	Lab.
Physics 4—General	4	6
Civil Engin. 14—Mechanics of materials	4	
Geology 4—Physical geology	3	
Economics	3	

Metallurgy 2—Assaying	2	9
Civil Engin. 10—Graphics		3
Mining 4—Ore dressing	2	
	18	18

Fourth Year.

First Semester—	Hours per Week. Lectures.	Lab.
Elec. Engin. 3—General	4	3
Geology 5—Economic	4	
Mining 5-7—Mine operation	5	
Mining 9—Mine design		6
Metallurgy 3—Gold and silver	2	
Metallurgy 5—Copper	3	
Metallurgy 9—Laboratory		3
Thesis		3
	18	15

Second Semester—	Lectures.	Lab.
Physics 6—Hydraulics	2	1½
Steam Engineering—Power plants and thermodynamics	3	1½
Geology 6— Economic	4	
Mining 6-8—Mining operation	5	
Mining 10—Mine design		6
Mining 12—Mine accounting	2	
Mining 14—Mining law	1	
Metallurgy 4—Iron and Steel	2	
Thesis		6
Metallurgy 12—Mill run		week
	19	15

METALLURGICAL ENGINEERING COURSE.

First Year.

First Semester—	Hours per Week. Lectures.	Lab.
Mathematics 7—Trigonometry	5	
Chemistry 3—General	4	6
Geology 1—General	4	3

English 9—Composition	4	
Civil Engin. 1—Mechanical drawing		6
	17	15

Second Semester—	Lectures.	Lab.
Mathematics 8—Analytic geometry	5	
Chemistry 4-6—General and qualitative	4	6
Geology 2—General	4	3
English 10—Composition	4	
Civil Engin. 2—Mechanical drawing		6
	17	15

Second Year.

	Hours per Week.	
First Semester—	Lectures.	Lab.
Mathematics 9—Calculus	5	
Chemistry 7—Qualitative	3	6
Mineralogy 1—General	2	3
Civil Engin. 3—Descriptive geometry	1	3
Civil Engin. 5—Surveying	2	6
Mining 1—Breaking ground	3	
	16	18

Second Semester—	Lectures.	Lab.
Mathematics 10—Calculus	5	
Chemistry 8—Quantitative	2	12
Mineralogy 2—Blow-pipe	2	6
Civil Engin. 6—Surveying	3	3
Mining 2—Tunneling, shaft sinking	2	
	14	21

Summer surveying three weeks.

Third Year.

	Hours per Week.	
First Semester—	Lectures.	Lab.
Physcs 3—General	3	3
Physics 5—Analytic mechanics	4	
Chemistry 9—Metallurgical	2	6
Civil Engin. 7—Topographic drawing		1½
Civil Engin. 9—Machine design		6

Mining 3—Ore dressing	3	3
Metallurgy 1—General	3	
	15	19½

Second Semester—	Lectures.	Lab.
Physics 4—General	4	6
Civil Engin. 14—Mechanics of materials	4	
Economics	3	
Metallurgy 2—Assaying	2	9
Civil Engin. 10—Graphics		3
Mining 4—Ore dressing	2	
Metallurgy 4—Iron and steel	2	
	17	18

Fourth Year.

	Hours per Week.	
First Semester—	Lectures.	Lab.
Elec. Engin. 3—General	4	3
Metallurgy 3—Gold and silver	2	
Metallurgy 5—Copper	3	
Metallurgy 11—Laboratory		6
Metallurgy 13—Laboratory		9
Mining 5—Mine operation	2	
Thesis		3
Chemistry 11—Electro chemistry	2	
Metallurgy 7—Lead, etc.	2	
	15	21

Second Semester—	Lectures.	Lab.
Physics 6—Hydraulics	2	1½
Steam Engineering—Power plants and thermo dynamics	3	1½
Metallurgy 6—Zinc, etc.	2	
Metallurgy 14—Electrometallurgy	2	
Metallurgy 8—Calculations	2	
Metallurgy 10—Metallurgical design		6
Mining 6—Compressed air	2	
Mining 12—Mine accounting	2	

Mining 14—Mining law	1	
Thesis		6
Metallurgy 12—Mill run		week
	16	15

CIVIL ENGINEERING COURSE.

First Year.

	Hours per Week.	
First Semester—	Lectures.	Lab.
Mathematics 7—Trigonometry	5	
Chemistry 3—General	4	6
Geology 1—General	4	3
English 9—Composition	4	
Civil Engin. 1—Mechanical drawing		6
	17	15

Second Semester—	Lectures.	Lab.
Mathematics 8—Analytic geometry	5	
Chemistry 4-6—General and qualitative	4	6
Geology 2—General	4	3
English 10—Composition	4	
Civil Engin. 2—Mechanical drawing		6
	17	15

Second Year.

	Hours per Week.	
First Semester—	Lectures.	Lab.
Mathematics 9—Calculus	5	
Physics 3—General	3	3
Mineralogy 1—General	2	3
Civil Engin. 3—Descriptive geometry		6
Civil Engin. 5A—Surveying	3	6
Mining 1—Breaking ground	3	
	16	18

Second Semester—	Lectures.	Lab.
Mathematics 10—Calculus	5	
Physics 4—General	4	6

Civil Engin. 4A—Descriptive geometry		6
Civil Engin. 6A—Surveying	3	6
Civil Engin. 8—Astronomy	2	
Mining 2—Tunneling, shaft sinking	2	
	16	18

Summer surveying six weeks.

Third Year.

First Semester—	Hours per Week. Lectures	Lab.
Physics 5—Analytic mechanics	4	
Civil Engin. 7A—Topographic drawing		3
Civil Engin. 9—Machine design		6
Civil Engin. 11—Graphics		3
Civil Engin. 13—Railroad engineering	4	3
Civil Engin. 15—Cement and concrete	2	
Metallurgy 1—General	3	
Sociology	3	
	16	15

Second Semester—	Lectures.	Lab.
Civil Engin. 12—Graphics		3
Civil Engin. 14A—Mechanics of materials	5	
Civil Engin. 16—Testing	2	6
Civil Engin. 18—Stereotomy		3
Civil Engin. 26—Sewers	2	
Steam Engineering—Power plants and thermodynamics	3	1½
Metallurgy 4—Iron and steel	2	
Economics	3	
	17	13½

Fourth Year.

First Semester—	Hours per Week. Lectures.	Lab.
Elec. Engin. 3—General	4	3
Civil Engin. 23—Roofs and bridges	3	6
Civil Engin. 25—Dams and retaining walls	3	

Civil Engin. 27—Arches and foundations	2	
Civil Engin. 29—Roads and pavements	3	
Civil Engin. 31—Contracts and specifications	1	
Thesis		6
	16	15

Second Semester—	Lectures.	Lab.
Physics 6A—Hydraulics	4	3
Civil Engin. 24—Roofs and bridges	3	6
Civil Engin. 30—Irrigation, water power and supply	5	
Civil Engin. 32—Framed structures	3	3
Thesis		6
	15	18

ELECTRICAL ENGINEERING COURSE.

First Year.

First Semester—	Hours per Week. Lectures.	Lab.
Mathematics 7—Trigonometry	5	
Chemistry 3—General	4	6
Geology 1—General	4	3
English 9—Composition	4	
Civil Engin. 1—Mechanical drawing		6
	17	15

Second Semester—	Lectures.	Lab.
Mathematics 8—Analytic geometry	5	
Chemistry 4-6—General and qualitative	4	6
Geology 2—General	4	3
English 10—Composition	4	
Civil Eng. 2—Mechanical drawing		6
	17	15

Second Year.

First Semester—	Hours per Week. Lectures	Lab.
Mathematics 9—Calculus	5	
Elec. Engin. 1—Elementary	2	3
Civil Engin. 3—Descriptive geometry	1	3
Civil Engin. 5—Surveying	2	6
Civil Engin. 9—Machine design		6
Physics 3—General	3	3
	13	21

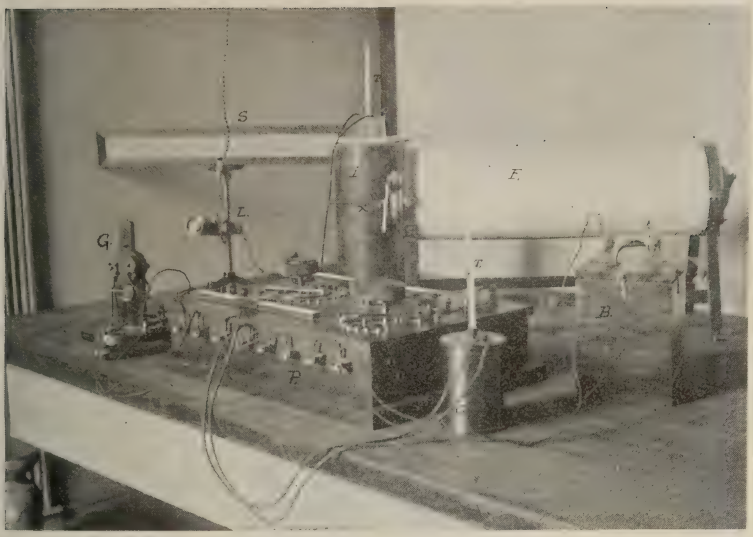
Second Semester—	Lectures.	Lab.
Mathematics 10—Calculus	5	
Elec. Engin. 2—Elementary	2	3
Civil Engin. 4—Descriptive geometry.		3
Civil Engineering 6E—Surveying	3	3
Civil Engin. 10—Graphics		3
Physics 4—General	4	6
	14	18

Summer surveying two weeks.

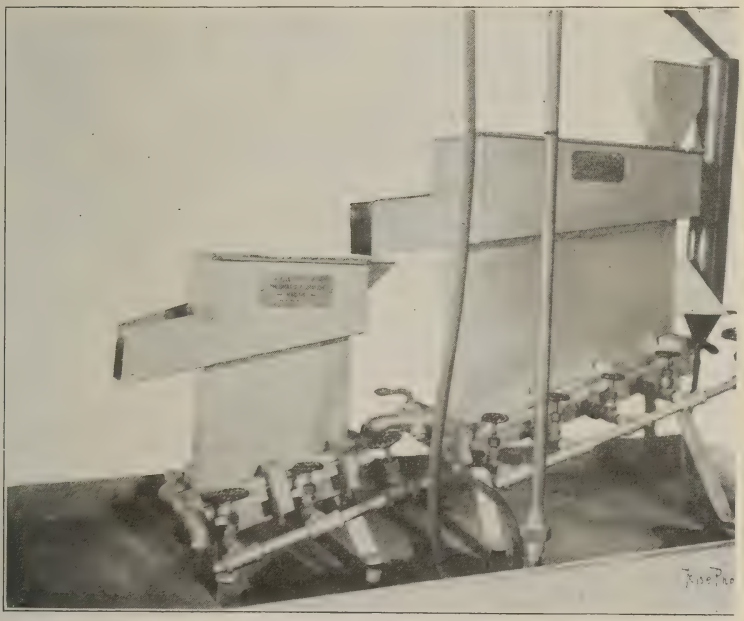
Third Year.

First Semester—	Hours per Week. Lectures.	Lab.
Mathematics 11—Differential equations	3	
Physics 5—Analytic mechanics	4	
Elec. Engin. 3—General	4	3
Elec. Engin. 5—Measurements		6
Elec. Engin. 3A		6
Sociology	3	
Metallurgy 1—General	3	
	17	15

Second Semester—	Lectures.	Lab.
Physics 6—Hydraulics	2	1½
Steam Engineering—Power plants and thermodynamics	3	1½
Civil Engin. 14—Mechanics of materials	4	



APPARATUS FOR STUDYING HIGH TEMPERATURES



CALLOW STANDARD TEST APPARATUS

Civil Engin. 16E—Testing laboratory.	2	3
Economics	3	
Elec. Eng. 8—A. C. Laboratory		6
Elec. Engin. 10—A. C. Theory	4	
Shop Work 8—Winding laboratory		3
	18	15

Fourth Year.

	Hours per Week.	
First Semester—	Lectures	Lab.
Electro-chemistry	3	
Elec. Engin. 9—Distribution and control	3	
Elec. Engin. 11—A. C. machinery	4	
Elec. Engin. 13—Laboratory		6
Elec. Engin. 15—A. C. Theory	3	
Elec. Engin. 17—Steam electric plants	2	
Electrical design		6
Thesis		6
	15	18

Second Semester—	Lectures.	Lab.
Elec. Engin. 12—Hydro-electric plants	3	
Elec. Engin. 14—Laboratory		6
Elec. Engin. 16—Telegraphy and telephony	2	
Elec. Engin. 18—Elec. railways	3	
Elec. Engin. 22—Illumination	2	
Elec. Engin. 24—Management	3	
Electric design		6
Metallurgy 14—Electro-metallurgy	2	
Thesis		6
	15	18

Engineering students wishing to study Spanish, French or German, have the privilege of taking a five hour course in these subjects by making proper arrangements therefor, providing the total number of lecture hours carried does not exceed eighteen per week.

PREPARATORY SCIENCE COURSE.

First Year.

First Semester—	Hours per Week. Lectures.	Lab.
Mathematics 1—Algebra	5	
English 1—Composition	5	
Biology 1—General biology	3	3
History 1—Ancient history	5	
Shop Work 1—Wood Shop		6
	18	9

Second Semester—	Lectures.	Lab.
Mathematics 2—Algebra	5	
English 2—Composition	5	
Biology 2—General biology	3	3
History 2—Mediaeval history	5	
Shop Work 2—Wood shop		6
	18	9

Second Year.

First Semester—	Lectures.	Lab.
Mathematics 3—Geometry	5	
English 3—Rhetoric	5	
History 3—Modern history	5	
Biology 3—Botany	3	3
Shop Work 3—Forging		3
	18	6

Second Semester—	Lectures.	Lab.
Mathematics 4—Geometry	5	
English 4—Rhetoric	5	
History 4—U . S. history	5	
Biology 4—Botany	3	3
Shop Work 4—Molding and casting		3
	18	6

Third Year.

First Semester—	Lectures.	Lab.
French 1 or Spanish 1 or German 1	5	
Astronomy	3	3

Biology 5—Zoology	3	6
English 5	5	
	16	9

Second Semester—	Lectures.	Lab.
French 2 or Spanish 2 or German 2	5	
Biology 6—Zoology	5	3
English 6	5	
Physical Geography	3	3
Freehand Drawing		3
	18	9

Fourth Year.

First Semester—	Lectures.	Lab.
Chemistry 1	3	6
French 3 or Spanish 3 or German 3 or 5, or English 7	5	
Physics 1	4	6
Mathematics 5—Geometry	5	
	17	12

Second Semester—	Lectures.	Lab.
Chemistry 2	3	6
French 4 or Spanish 4 or German 4 or 6 or English 8	5	
Physics 2	4	6
Mathematics 6—Algebra	5	
	17	12

GEOLOGY AND MINERALOGY.

Professor O'Harra Professor Runner

Library, Laboratory and Field Facilities.

A good, well equipped departmental library is placed convenient to the lecture and laboratory rooms and students are required to make intelligent use of the literature contained therein.

The laboratory equipment and the museum collections, elsewhere described, furnish indispensable material for practical work of many kinds.

Field facilities are unsurpassed. Unusual opportunity is offered for study in the field of the various geological horizons, including important and valuable economic deposits. Within a few miles of the school the student may observe upturned strata of nearly all geological ages. Twenty miles southwest of Rapid City is the Harney Peak granite area, with its lavish variety of mineral specimens. Surrounding this is a wonderful exposure of Algonkian metamorphic rocks cut in many places by auriferous quartz veins. The Cambrian, Carboniferous, Triassic, Jurassic, and Cretaceous are extensively developed. The famous White River Badlands of Tertiary age lie to the southeast of the Hills and afford fossils which have made the region known wherever the science of Paleontology is taught. In the northern part of the Hills important igneous rocks, such as rhyolite, phonolite, andesite, dacite, etc., occur in the form of dikes, sheets and laccoliths. Closely associated with these in slates, quartzites, and limestones, gold ores of the greatest importance are found.

In the autumn, short field excursions are made by the class to nearby points of interest and occasionally a visit of several days is made to more distant localities. Thus the student, in addition to lecture and laboratory instruction, has the advantage of systematically directed field study and with the information thus gained, he should be able to undertake for himself the working out of practical field problems.

Geology 1-2.

General Geology: This course is arranged primarily as introductory to all work in geology and mineralogy. It extends throughout the Freshman year and embraces a comprehensive study of the fundamental principles of geology. The course includes brief, but careful study of dynamical, stratigraphical, structural, chemical and historical geology, and is conducted by means of lectures, text books, and laboratory work, and frequent excursions to points of particular interest. Under dynamic geology, the atmospheric, aqueous, igneous, and organic agencies are discussed with reference to their bearing on the present and past condition of the earth's surface. Stratigraphical and structural geology consider the conditions of deposition of sediments and of the disturbance of rock masses. A portion of the time allotted to these subjects is devoted to the study of such minerals and rocks as enter largely into the structure of the earth's surface; also to the methods of geological surveying, including mapping, section making, special problems. Chemical geology includes the study of the general relation which chemistry bears to geological phenomena, such as the formation, metamorphism, and degeneration of rocks, and the origin and alterations of the various kinds of mineral deposits. Under historical geology, the physical history of the earth is discussed, the classification and distribution of sedimentary rocks studied, and the methods of correlation explained. The course aims to equip the student with useful information concerning the phenomena and history of the earth, so that he may know the methods used in geological research, and will better understand how to interpret facts gained in the study of economic deposits.

Freshman Year. Four lecture periods and three laboratory hours per week throughout the year.

Text Book: Pirsson's Text-book of Geology. Miller's Introduction to Historical Geology.

Mineralogy 1.

Crystallography: Eight weeks are given to the study of symmetry, forms and classifications of crystals. In the laboratory the student becomes familiar wth the various types of crystals through the study of models and later is required to identify the forms of one hundred mineral crystals.

Physical Mineralogy: The remainder of the semester is devoted to the physical properties of minerals in general and the composition, forms, properties, occurrence, association, origin and uses of one hundred of the more common minerals are studied in detail. In the laboratory seven hundred unlabeled specimens of the minerals discussed in the class room are determined from their physical properties alone. The course is planned to develop such information as may be needed for the quick and accurate determination of minerals in the field.

Sophomore Year, First Semester. Two lecture periods and three laboratory hours per week. Text: Phillips' Mineralogy.

Mineralogy 2.

General Mineralogy and Blowpipe Analysis: The chemical properties and relations of minerals and the methods of blowpipe and other chemical analysis for their determination are first studied, after which the chemical and physical properties, origin, associations and uses of about one hundred mineral species are taken up, special emphasis being paid to ore and common rock forming minerals. The laboratory work consists of the determination of approximately one thousand four hundred unlabelled specimens of minerals by means of chemical tests and physical properties. A detailed report of all results obtained is made out and kept for reference. It is expected that upon completion of this and the preceding course the student will have gained a good working knowledge of over two hundred of the common minerals, including the chief factors of their distribution, uses, value and output.

Sophomore Year, Second Semester. Two lecture periods and six laboratory hours per week.

Text Books: Phillips Mineralogy; Lewis' Determinative Mineralogy.

Geology 3.

Optical Mineralogy: This course is mainly introductory to the study of Petrography. It aims to enable the student to recognize the common minerals by means of the microscope. A discussion of the principles and phenomena of light, such as reflection, refraction, interference is offered and the different media and their wave fronts, optical signs and indicatrices receive special attention. This is succeeded by an application of these laws in the movement of light in different crystals, and the use of the petrographic microscope in the identification of minerals in thin sections. For laboratory work excellent Zeiss and Leitz microscopes are available. The fairly extensive collection of thin sections includes a special set of 120 oriented mineral sections manufactured by Krantz.

Petrography: This course is intended for mining students who need some training in rock determination, but who have opportunity to devote only a short time to the subject. It embraces the study of rocks, both under the microscope and in hand specimens. The lectures are devoted to a general discussion of the principles of rock classification, special attention being given to the system of Kirkel and Rosenbusch modified as in use in America, which is followed by a brief summary of the Quantitative system. The origin, distribution, mode of occurrence and relations of rock masses and contact metamorphism are included. The principles of regional metamorphism and a classification of metamorphic rocks follow. For the laboratory work a Kranz collection of 350 rocks and thin sections is available. In addition, there is a fairly complete collection of Black Hills rocks, most of which are thin sectioned. There is also a set of unlabeled rocks with accompanying thin sections representing all common types, which are used for description and study by the student.

The Black Hills offer an exceedingly interesting field for the petrographer on account of the great variety of rock types within their small area. When possible field excursions will be taken to points of interest, especially to the metamorphic and igneous areas.

Junior Year, First Semester, Mining Engineering Option: Three lecture periods and four and one-half laboratory hours per week.

Reference books. Manual of Petrographic Methods, Johannsen. Determination of Rock Forming Minerals, Johannsen. Rock Minerals, Iddings. Igneous Rocks, Iddings. Igneous Rocks and Their Origin, Daly. The Natural History of Igneous Rocks, Harker. Petrology for Students, Harker. Lecture Notes.

Geology 4.

Structural Geology: The course begins with a resume of the different hypotheses of earth origin and those concerning the interior condition of the earth. Vulvanism in its broader aspects, its causes and manifestations is next taken up, followed by a brief summary of the modern ideas on diatrophism and isostasy. Rock fractures, flowage, faults and folds are discussed in their relations to deformative stresses and the major units of earth structure in their proper relations. Special attention is given to the solution of problems in faulting and folding that have a bearing on the practical work of the miner.

Junior Year, Second Semester, Mining Engineering Option. Three lecture periods per week.

Reference Texts: Leith's Structural Geology. Leith & Mead's Metamorphic Geology. Lahee's Field Geology.

Geology 5-6.

Economic Geology: This course runs throughout the Senior year and includes study of the origin, modes of occurrence and uses of economic mineral products. About one-half of the first semester is given to the study of non-metallic products. This includes the origin, nature, relations and values of coal,

petroleum, natural gas, salines, building stone, clays, cement materials, fertilizers, abrasives, gems, etc. The rest of the course is devoted to the study of metallic products, such as gold, silver, copper, iron, lead, zinc, platinum, mercury, nickel, etc. In this much attention is given to the study of the principles of ore deposition and to the historical development of the theories connected therewith. Careful attention is given to the chief types of deposits and particularly to localities noted for their wealth of output.

Maps, specimens, and original papers are freely used. Attention is given to the history of mineral development, of the life and comparative importance of various regions and of the influence which economic deposits have exerted upon the regions or countries in which such deposits have been found.

The necesssity of individual examination by the student of the best up-to-date literature is insisted upon, and a reasonable ability to properly use such literature is required. Much attention is devoted to the study of the many economic interests of the Black Hills region and observation of the deposits in the field is encouraged.

Senior Year, Mining Engineering Option: Four lecture periods per week throughout the year.

Reference Texts: Beck-Weed's Nature of Ore Deposits; Ries' Economic Geology; Kemp's Ore Deposits of the United States and Canada; Lindgren's Mineral Deposits; Beyschlag, Vogt & Krusch's Ore Deposits. Emmons' Principles of Economic Geology.

CIVIL ENGINEERING.

Professor Mangold.

The aim of this department is to give the student such training in the class room, drawing room, laboratory and field as will properly fit him for entrance to an engineering career.

The endeavor will be to give him enough practical knowledge to enable him on graduation to fill with credit a subordinate professional position and to teach him so much of the underlying theory and principles as to permit him when he has clothed these with experience of his own to rise to the higher ranks of his calling.

The department occupies two well lighted drawing rooms, 24x34 and 24x30 feet in size, lecture rooms and offices. The drawing rooms are furnished with suitable drawing desks which have separate lockers for each student.

The work of this department extends over a period of four years and includes the following courses:

Civil Engineering 1-2.

Mechanical Drawing: Practical work in the drawing room accompanied by lectures as needed. The work is carried on chiefly by means of individual instruction. The course includes the care and use of instruments; the mounting of sheets; simple geometric constructions; orthographic, isometric and cabinet projection, machine details, and both freehand and mechanical lettering of titles. Tracing and blue printing are taught in this course.

Students taking this course should provide themselves with the following list of supplies, most of which may be obtained from the supply room of the department at cost:

One set of drawing instruments containing:
One pair 6-in. compasses, with pen, pencil and needle points.
One pair 6-in. dividers,

One 5½-in. ruling pen,
One 3½-in. steel spring bow divider,
One 3½-in. steel spring bow pencil,
One 3½-in. steel spring bow pen,
One T square with 30-in. blade,
One 4½-in. protractor,
One irregular curve,
One 7-in. 30° by 60° triangle,
One 8-in. 45° triangle.

Drawing paper, pencils, ink, erasers, etc., may be purchased from the department at cost.

French's Engineering Drawing is used as a text book.

Drawing boards and key for locker are furnished by the school on the payment of a fee of $1 per year; 50 cents of this is refunded on return of key and board.

Freshman Year: Six laboratory hours per week throughout the year.

Civil Engineering 3-4.

Descriptive Geometry: This work includes the projection of the point and the line and the representation of planes, with numerous problems relating thereto, and the generation, classification and intersection of curves and surfaces. Drafting room work with individual talks.

Sophomore Year, First Semester. One lecture and three laboratory hours per week; second semester, three laboratory hours per week.

Text Book: Higbee's Descriptive Geometry.

Civil Engineering 4A.

Descriptive Geometry: Similar to Civil Engineering 4, but including shades, shadows, and perspective.

Sophomore Year, Second Semester: Six Laboratory hours per week.

Civil Engineering 5-6

Surveying. Plane Surveying. It is the desire of the department to bring, as far as it is practic-

able, theory and practice side by side. Ample opportunity for field work is provided and the institution is provided with all the instruments and accessories necessary to carry on the work. Additional instruments are purchased as the need for them arises.

For the performance of the field work, the class is divided into squads with just sufficient number in each party to properly carry on the work. Each student is required to take his turn at every part of the work; to use each instrument as the occasion demands; to make his notes and computations; and finally to accurately plot them in the drawing room.

The course outlined is as follows: Linear measurements by means of pacing and chain or tape; adjustment and use of the engineer's transit and level; traversing; principles of land surveying; adjustments and use of the plane-table; adjustment and use of the solar instrument; topographic surveying, determination of the meridian by means of the solar instrument; direct solar observation and observation on Polaris; measurements of volumes. Railroad surveying and city surveying will receive as much time as the conditions will permt. Trigonometry is a prerequisite.

Mine Surveying: The location and patent survey of mineral claims; carrying the meridian underground via vertical and inclined shafts; underground traversing and leveling; underground connections; measurements of ore reserves and stope volumes; note taking and plotting.

Sophomore Year: Two lecture periods and six hours field work per week during the first semester and three lectures and three hours field work during the second semester.

A three weeks' summer school for practical work immediately follows the close of school in June. This includes two weeks of plane surveying and one week of mine surveying underground.

Text Book: Tracy's Plane Surveying.

Civil Engineering 5A-6A

Surveying: Course similar to Civil Engineering 5-6, but amplified for Civil Engineering students. In addition to the subjects mentioned under the preceding course, this course treats of geodetic surveying including base line measurement, triangulation and measurement of angles, trigonometric and precise leveling and map projection.

Three hours lectures and six hours field work per week during the Sophomore year, followed by six weeks summer field work.

Civil Engineering 6E

Plane Surveying: Same as Plane Surveying under Course 6, but does not include Mine Surveying. Sophomore Year. Electrical Engineerng Course, Second Semester. Three hours lectures per week for one half semester; three hours field work per week for one semester, followed by two weeks summer field work.

Civil Engineering 7

Topographic Drawing: This work embraces the accurate drawing of maps, including topographic features, and the plotting of profiles. Many of the notes taken in the preceding summer's field work are thus worked up in the drafting room.

Prerequisite Civil Engineering 5-6.

Junior Year, First Semester: Three laboratory hours per week for eight weeks.

Civil Engineering 7A

Topographic Drawing: This course includes the same subjects as Course 7, but the work is amplified for Civil Engineering students. Prerequisite Civil Engineering 5A-6A.

Junior Year, First Semester: Three laboratory hours per week.

Civil Engineering 8

Astronomy: A short course in Field Astronomy for Civil Engineering students, special atten-

tion being given to the observations for azimuth, latitude, longtitude and time. The school possesses a superior three inch astronomical telescope with achromatic finder and four eye pieces. Sophomore year, Second Semester: Two lecture periods per week.

Civil Engineering 9

Machine Design: The drawing of screw threads, keys, fastenings, the various forms of gear teeth, bevel gears, bearings, cams, quick return motions, etc. It is designed to make this course eminently practical, an introduction to those problems which continually meet the designing engineer and which the principles of machine design alone will help him to solve. Drafting room work with talks as needed and library references.

Junior Year, First Semester: Six laboratory hours per week.

Civil Engineering 10-11-12

Graphical Statics: The object of this course is to give an understanding of the theory of the graphical solution of internal stresses in a framed structure, arising from steady and moving loads, from the pressure of the wind, etc. The student is required to determine by graphical methods on the drawing board, the nature and amounts of internal stresses in the various members of such simple roof and bridge trusses and head frames as are assigned him.

Junior Year: Three laboratory hours per week. Courses 11-12 is for Civil Engineering students and extends throughout the year. Course 10 is for all other students and is given during the second semester.

Text Book: Malcolm's Graphic Statics.

Civil Engineering 13

Railroad Engineering: The organization of a railroad company, the permanent way, rails, ties, roadbed, ballast, bridges, culverts, yards, elevation of outer rail, signals, locomotives, curves and grade

problems, surveying for location and construction. Plane surveying is a prerequisite. Raymond's Elements of Railroad Engineering is used.

Junior Year, First Semester, Civil Engineering Course. Four lecture hours and three laboratory hours per week.

Civil Engineering 14

Mechanics of Materials: The resistance and elasticity of the materials of engineering; fundamental assumptions of the common theory of beams; distribution of stresses in beams; shearing forces, bending moments, and deflections of beams; the theory of torsion, flexure, elastic limits; working stresses and ultimate stresses and ultimate resistance of cast iron, wrought iron, steel and timber; pipes and riveted joints; posts and columns; the design of posts, beams, shafts, etc.

Junior Year, Second Semester: Four lecture periods per week.

Text Book: Boyd's Strength of Materials.

Civil Engineering 14A

Mechanics of Materials: This is a somewhat more extended course than the preceding, and is given five lecture hours per week. It includes all the work given in the text book above mentioned.

Junior Year, Second Semester, Civil Engineering Course.

Civil Engineering 15

Cement and Concrete: The composition, manufacture and use of Portland and natural cements, the mixing and placing of plain and reinforced concrete, the theory and calculation of reinforced concrete.

Junior Year, First Semester, Civil Engineering Course. Two lecture periods per week.

Civil Engineering 16

Testing Materials: A laboratory course with explanatory lectures. Must be accompanied or preceded by Civil Engineering 14 or 14A.

Junior Year, Second Semester, Civil Engineering Course. Two hours lectures and six hours laboratory work per week.

Civil Engineering 16E

Testing Materials: A course for Electrical Engineering students, similar to Civil Engineering 16, but with the laboratory work abridged to three hours per week. Second Semester, Junior Year.

Civil Engineering 18

Stereotomy: Drafting room work with lectures as needed. Descriptive geometry applied to the detail drawing of masonry arches and other structures with plane, curved or warped surfaces. The drawing room courses of the first two years are prerequisites.

Junior Year, Second Semester, Civil Engineering Course. Three laboratory hours per week.

Civil Engineering 23-24

Roofs and Bridges: A study of the usual designs of roof and bridge trusses, with calculations of stresses and drawing room work in design. Must be preceded by Civil Engineering 11-12.

Senior Year, Civil Engineering Course. Three lecture periods and six laboratory hours per week during the year.

Civil Engineering 25

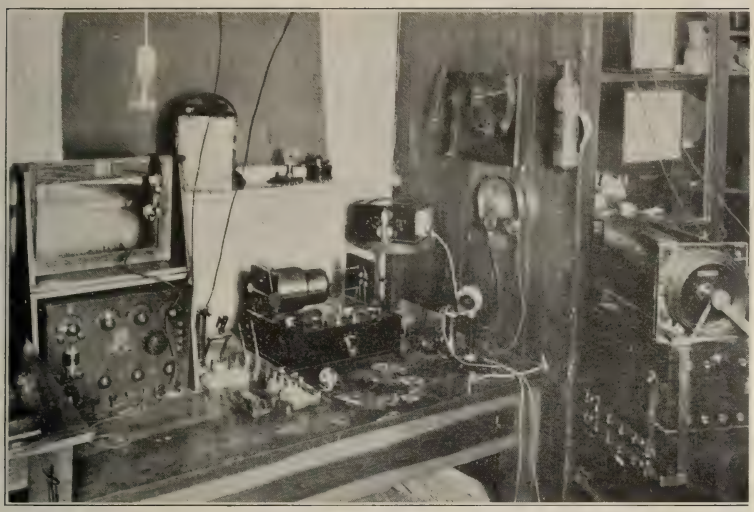
Dams and Retaining Walls: A study of various types of dams and weirs, including timber, earth, masonry and rock fill dams, and of retaining walls.

Senior Year, First Semester, Civil Engineering Course. Three lecture periods per week.

Civil Engineering 26

Sewers: The various ways of disposal of sewage, sewer design and construction.

Junior Year, Second Semester, Civil Engineering Course. Two lecture periods per week.



WIRELESS APPARATUS

STUDENTS STUDYING FLUME OF HYDRO-ELECTRIC PLANT NEAR RAPID CITY

Civil Engineering 27

Arches, Masonry and Foundations: The theory and design of arches, the methods and materials of construction of foundations and masonry structures.

Senior Year, First Semester, Civil Engineering Course. Two lecture periods per week.

Civil Engineering 29

Roads and Pavements: The modern construction of earth roads, country highways, city streets and pavements, materials, methods, economics and costs.

Senior Year, First Semester, Civil Engineering Course. Three lecture periods per week.

Civil Engineering 30

Irrigation, Water Power and Supply: The storage and distribution of water for irrigation and power. Water works for small cities.

Senior Year, Second Semester, Civil Engineering Course. Five lecture periods per week.

Civil Engineering 31

Contracts and Specifications. A course of one hour per week of reading and recitations.

Senior Year, First Semester, Civil Engineering Course.

Civil Engineering 32

Framed Structures: Structural details, the principles of detail, design of members and joints in timber and steel construction.

Senior Year, Second Semester, Civil Engineering Course. Three lecture periods and three laboratory hours per week.

PHYSICS AND ELECTRICAL ENGINEERING

Professor Swisher

The courses in Physics are designed to give to the student a broad, general knowledge of the whole subject, as well as the knowledge most essential to the work in his branch of engineering.

In Electrical Engineering the courses of the first three years are intended to lay the foundations for study in both direct and alternating current work. During the fourth year more specialized courses are offered, giving opportunity to apply the general principles to more technical problems.

The courses offered by the department are as follows:

Physics 3

Mechanics of Solids and Fluids, Sound and Heat: In mechanics especial attention is given to the empirical and practical aspects of the subject, while the more theoretical results are considered in Physics 5. Particular emphasis is laid upon the laws of motion, friction, work and energy, and hydromechanics.

In heat particular attention is given to the expansion of gases and vapors, specific heat, and to the energy relations of heat, giving the student a good foundation for Thermodynamics.

The aim of the laboratory work in this and the following course is not so much to perform a large number of experiments as to learn to work with care and accuracy. Determinations are made of the coefficient of friction, specific gravity, velocity, rate of vibration and analysis of sounds.

In heat especial attention is given to the determination of specific heat, heat of fusion, heat of vaporization, melting and boiling points, coefficient of expansion of solids, liquids and gases, and the determination of the mechanical equivalent of heat, and the plotting of cooling and freezing point curves.

First Semester: Sophomore Year for Civil and Electrical Engineers, Junior Year for Mining and Metallurgical Engineers. Three lecture periods and three laboratory hours per week.

Text Book: Reed and Guthe-College Physics.

Physics 4

Magnetism and Electricity, Light: The subject of electricity receives detailed consideration. The laws of electrostatics, resistance, electrolysis, electromagnetism and electromagnetic induction are considered in detail, and a careful study of the theory of electrical measurements is made.

The subject of light is considered from the standpoint of the electromagnetic theory and a careful study is made of reflection, refraction, dispersion, interference, diffraction and polarization and of the theory of optical measurements.

In the laboratory special emphasis is placed on electrical work and optical instruments. The laboratory is well equipped for that work.

The school machine shop is at the disposal of students for the purpose of constructing apparatus for research work.

Second Semester, as above. Four lecture periods and six laboratory hours per week.

Physics 5

Analytic Mechanics: In this course the fundamental principles of mechanics are developed and a large number of problems are worked giving the practical applications of these principles to engineering. Special effort is made to develop in the student the ability to attack and work out problems for himself. Calculus methods are used freely when needed.

Some of the more important topics taken up are as follows: Composition and resolution of forces; conditions of equilibrium; centers of gravity, moments of inertia; laws of motion; friction; work and energy.

Junior Year, First Semester. Four lecture periods per week.

Physics 6

Hydraulics: The student takes up this course with a knowledge of hydrostatics from his work in Physics 3, and is thus prepared to commence with hydraulics proper, or the study of the laws governing the motion of water.

The school is favorably situated for field work in hydraulics. Rapid creek is a mountain stream with a fall of about 1.6 per cent., offering splendid facilities for wier and velocity measurements; two large irrigation ditches are adjacent to the school, and Rapid City has three water-power plants within the city limits. The students thus have opportunity to visit and study hydraulic power plants in successful operation.

Senior Year, Second Semester: Two lecture periods per week, and three laboratory hours per week for eight weeks. Junior Year for Electrical Engineering students.

Text Book: Mansfield Merriman's Treatise on Hydraulics.

Physics 6A

Hydraulics: A more extended course than Physics 6, for Civil Engineering students.

Senior Year, Second Semester. Four lecture periods and three laboratory hours per week.

Electrical Engineering 1-2

An elementary course in electrical manipulation for Electrical Engineering students including telephone and telegraph circuits, wiring, bells, wiring diagrams and elementary machine connections. Sophomore Year, Electrical Engineering Course. Two lecture periods and three laboratory hours per week.

Electrical Engineering 3

This course deals with the principles and general construction of dynamoelectric machinery, systems of direct current distribution; direct current motors, their action control and application; the

principles and general construction of alternating dynamo electric machinery; systems of alternating current distribution, and alternating current motors. In the laboratory, practice is acquired in the use of instruments in the operation and testing of direct and alternating current generators, motors and transformers.

First Semester, Junior Year of Electrical Engineering Course, Senior Year of all other courses: Four lecture periods and three laboratory hours per week throughout the semester.

Text Book: Gray, Principles and Practice of Electrical Engineering.

Electrical Engineering 3A.

This course is taken parallel with and is intended to be supplementary to Course 3 for Electrical Engineers.

Junior Year, First Semester, Electrical Engineering Course. Two hours per week.

Electrical Engineering 5.

Electrical Measurements: Junior Year Electrical Engineering Course. Six laboratory hours per week during the first semester.

Electrical Engineering 8.

Alternating Current Laboratory, Junior Year, Second Semester, Electrical Engineering Course: Three laboratory hours per week.

Electrical Engineering 10.

Alternating Current Theory: In this course the fundamental principles underlying alternating current calculations are developed. A large number of problems applying these principles are worked out and discussed at length.

Junior Year, Second Semester, Electrical Engineering Course. Four lecture periods per week.

STEAM ENGINEERING.

Thermo-Dynamics: This course begins with a discussion of the theory underlying the operation of heat engines. The theory of operation of the ideal engine is developed, and the principles governing the action of steam and gas engines, air compressors and refrigerating machines are fully discussed.

Power Plants: This course applies practically the principles developed under thermodynamics. It embraces the history of the development of the steam engine, and a study of the types in successful use; the application of the indicator and the Prony brake; the study of the steam boiler, and the testing of boilers and fuels. A Thompson indicator, a Prony brake with Fairbanks scales, a Standard Crosby test gauge, and a Carpenter steam separating calorimeter are available for laboratory work.

The school has three boilers aggregating 250 horse-power, and a 40 horse-power Corliss engine; also a gasoline and a kerosene engine. This apparatus is also available for laboratory work in this course.

Second Semester. Junior Year for Civil and Electrical Engineering Courses, Senior Year for Mining and Metallurgical Engineering Courses. Three lecture periods per week for the semester and three laboratory hours per week for half a semester.

WIRELESS TELEGRAPHY.

The Physics Department is also in charge of the School of Mines Radio Station. This station is completely equipped with the most up to date sending apparatus and two complete receiving sets. One of these is for arc, or continuous waves, and has a guaranteed receiving radius of 9,000 miles. The other is for spark, or damped wave, signals. This is intended for sorter range than the other, but we have copied messages from all parts of the United States with it.

Effort is made to keep in step with the most recent developments in this relatively new branch of electrical work and new apparatus is being added as needed to keep it up to date. The receiving and sending of messages are for the present suspended because of the war situation.

CHEMISTRY.

Professor Hartmann.

The courses in Chemistry are designed to give to engineering students the knowledge of chemistry most essential to their work. The subject is given in all courses according to the modern electrolytic dissociation theories. The purpose is to excite in the student an interest in experimentation, to cultivate methods of accuracy and rapidty in manipulation and to teach the proper correlation of the results of experiments.

Chemistry 3-4.

General and Elementary Physical Chemistry. This course is designed to give to the student a knowledge of the theories and laws of the science as well as to increase his knowledge of general chemistry facts. Before entering this class the student must have had either Chemistry 1 and 2 (see Preparatory Announcement) or a good high school course in Chemistry. The following subjects are discussed: atoms and molecules, gases, liquids and solids, solutions, thermo- and electro-chemistry. Special attention is given to the theories of electrolytic dissociation and the law of mass action. The laboratory work in the first semester is designed to show the application of some of the principal generalizations.

Freshman Year. First Semester: Four lecture periods and six laboratory hours per week. Second Semester: Two lecture periods per week.

Text: W. A. Noyes Text-book of Chemistry.

Chemistry 6.

Qualitative Analysis: The work in qualitative analysis begins with an outline of the general scheme of analysis. A minute study of the separation and detection of the common acids and bases follows. Emphasis is placed upon the general principles of chemistry involved, especially the electrolytic dissociation theory and the mass action law. The aim of this course is to teach the student the reasons for every

step in the separation and identification of the elements and to develop the idea of quantity as well as quality.

Freshman Year, Second Semester. Two lectures and six laboratory hours per week.

Text Book: A. A. Noyes' Qualitative Chemical Analysis.

Chemistry 7.

Advanced Qualitative Analysis. An advanced course to follow Chemistry 6. The methods of analysis of commercial products and minerals are discussed fully. The detection of a number of the rarer elements is also a part of this course. The quantitative idea is emphasized.

Sophomore Year, First Semester. Three lectures and six laboratory hours per week.

Chemistry 8.

Quantitative Anaylsis. This course covers the general principles of quantitative analysis and includes the analysis of simple substances by both gravimetric and volumetric methods. The subject of chemical calculations is discussed and problems are solved.

Sophomore Year, Second Semester. Two lecture periods and twelve laboratory hours per week.

Text: Talbot's Quantitative Analysis.

Chemistry 9.

Metallurgical Chemistry: This course is to familiarize the student with the analytical methods used in conjunction with metallurgical processes. Especial reference is made to the analyses for the rare elements found in the Black Hills region, and to the technical methods connected with the metallurgy of iron, steel, zinc, lead and copper.

Junior Year, First Semester. Metallurgical Engineering Course. Two lecture periods and six laboratory hours per week.

Text: Lord & Demorest's Metallurgical Chemical Analysis.

Chemistry 11.

Electro-chemistry Theoretical and Applied. Senior Year, First Semester. Metallurgical and Electrical Engineering Courses. Two lecture periods per week.

Chemical Research.

Opportunity will be given for original research work along chemical lines to students qualified to undertake such work

METALLURGY.

Professor Traphagen.

Metallurgical subjects are taught by lecture courses with frequent reference to standard works on the subject, and to the current literature.

The lectures are supplemented, as far as possible, by laboratory work and experiments, and by excursions to neighboring metallurgical works. The school is favorably situated in being contiguous to an active gold mining district, the Black Hills, affording excellent opportunity to study the practical side of metallurgy, particularly that of gold, on a large scale and at close range. The stamp mills and cyanide plants of Lawrence county are easily reached by rail in two hours' time.

A well equipped metallurgical laboratory is available for use, and it is desirable that the student should be thoroughly trained in the basic scientific principles of metallurgy. With actual metallurgical operations, on a large scale, the student becomes familiar to such an extent as is desirable during his school years, by visits to the working plants of the district.

In the laboratory he becomes acquainted with the use of pyrometers, calorimeters, microscopes for the examination of metals and furnace products and other scientific metallurgical apparatus. He conducts experiments in the refining and heat treatment of steel, electric deposition of metals, formation of slags, refining of metals, cyanide process and amalgamation, etc. He becomes experienced to some extent with actual working of a furnace, stamp mill, concentrating tables and cyanide plant with which the laboratory is provided.

The department is equipped with a card index of metallurgical literature, which covers all of the subjects of interest completely, and is at the service of students.

Metallurgy 1.

Introductory Metallurgy: This course consists of lectures on the physical properties of metals; on alloys, their types, nature and properties; fuels; combustion; refractory materials, thermal measurements; discussions of metallurgical principles, slags and furnace products and their nature; types of furnaces and furnace construction; the means of supplying and heating blasts; thermo-chemistry, including a discussion of chemistry at high temperatures; typical metallurgical processes and the general economic considerations of metallurgy, such as buying and selling ores and metallurgical products. Students are required to do outside reading from references given in the class room and hand in for examination papers on topics assigned. Laboratory work covering part of this course is carried out in the Senior Year, and is described under Metallurgy 11.

Junior Year, First Semester: Three lecture hours per week.

Text-book: Hofman, General Metallurgy.

Metallurgy 2.

Assaying: This course is taught by lectures and by laboratory work, based on the lectures. Elementary chemistry, qualitative and quantitative analysis are prerequisites, being necessary for a thorough understanding of the work.

The work of the laboratory includes assaying of reagents, the testing of ores to discover their nature; the study of oxidizing and reducing reactions ocurring in assaying; the study of typical assay slags; the assaying of pure gold and silver ores by crucible and scorification methods; the special assaying of copper and zinc ores containing gold and silver; the assaying of arsenical and antimonial ores for gold and silver; the study of cupellation and the factors which influence its results; the assaying of impure ores by the roasting, the nitre, and excess litharge methods; the assaying of telluride ores, lead bullion, and cyanide precipitates for gold and silver;

the assaying of gold and silver bullion; the assaying of ores and alloy for platinum, iridium, etc.; the assaying of lead, tin, bismuth and antimony ores for their respective base metals; the dry assay of mercury ores for mercury; and concentration and free milling tests on a laboratory scale.

Junior Year, Both Options, Second Semester: Two lecture periods and nine laboratory hours per week.

Text-book: Fulton, Manual of Fire Assaying.

Metallurgy 3.

The Metallurgy of Gold and Silver: This course consists of lectures on the metallurgy of gold-silver, taking up first, modern stamp mill practice, discussing in detail mortar boxes, stamps, screens, general battery construction, etc., and the influence of weight of stamp, screen mesh, mortar box dimensions, amount of water, on results obtained. Inside and outside amalgamation is studied in detail; the general mill arrangements; clean up; the influences of other processes following amalgamation is discussed. Modern fine grinding in tube mills and other apparatus is investigated. This is followed by a discussion of the cyanide process for gold and silver ores; wet and dry crushing; crushing in cyanide solution; the separation of sands from slimes; the treatment of sands by percolation; the treatment of slimes by decantation, filter pressing and vacuum filtration; the precipitation of gold and silver by the various methods in use, methods of cleaning up, and the smelting of cyanide precipitates. The general chemistry of cyanidation is discussed. The chloridizing roasting of silver ores; pan amalgation; leaching process for silver ores, etc., concludes the course.

Senior Year, Mining and Metallurgical Engineering Course, First Semester. Two lecture periods per week. Lecture notes.

Reference works: Julian & Smart, Cyaniding of Gold and Silver Ores; Henry Louis, Handbook of Gold Mining; T. K. Rose, Metallurgy of Gold; Del Mar, Stamp Milling; McFarren, Cyanide Practice; Clennel, The Cyanide Handbook; Thomson, Stamp Milling and Cyaniding.

Metallurgy 4.

Iron and Steel: This course consists of lectures on iron alloys, their classification, structure, properties, metallography; taking up more particularly iron and steel. The hardening and tempering of steel is taken up in detail. The metallurgy of cast iron, wrought iron and steel is discussed in principle, but not in great detail. Especial attention is paid to the principles and chemistry of the iron blast furnace to the Acid Bessemer process, and to the Acid and Basic Open Hearth processes. Statistics of the iron and steel industry are given. The student is required to do considerable outside reading.

Junior Year, Both Options, Second Semester: Two lecture periods per week. Lecture notes.

Metallurgy 5.

The Metallurgy of Copper: This course consists of lectures on the modern metallurgy of copper. It discusses the types of copper ores and the methods suitable for the treatment of the different types. The principles of the reverberatory process for copper are discussed in detail, as they bring out clearly the chemistry of copper. Matte smelting for copper ores is discussed, both pyrite smelting and ordinary matte smelting being taken up in detail; also the roasting of copper ores. This is followed by the discussion of the Bessemerizing of copper mattes and the electrolytic refining of blister copper. Wet methods for copper ores are discussed.

Senior Year, Mining and Metallurgical Options, First Semester: Three lecture periods per week.

Reference works: Peters, Modern Methods of Copper Smelting; Schnabel, Handbook of Metallurgy; Peters, Principles of Copper Smelting.

Metallurgy 6.

Zinc, Nickel, Tin, Mercury, etc. A series of lectures dealing with the theory and practice in the treatment of the above mentioned and other metals.

Senior Year, Metallurgical Option, Second Semester: Two lecture periods per week.

Metallurgy 7.

Lead, Cadmium, Bismuth and Antimony. Lectures treating of the smelting of lead ores in the open hearth, reverberatory and blast furnaces, including the roasting of ores, composition of lead slags, the products of the furnace, etc. The practice of large centrally located plants, treating both mixed lead and copper ores is taken up, also the desilverization of lead bullion, and the refining of lead.

The metallurgy of cadmium, bismuth, and antimony is also considered.

Senior Year, First Semester, Metallurgical Option. Two lecture periods per week.

Metallurgy 8.

Metallurgical Calculations: A course based on Richards' Metallurgical Calculations. It is designed to make the student familiar with the more important caluclations in connection with the practice of thermo-chemistry, copper smelting, lead smelting and electro-metallurgy.

Metallurgical Option, Senior Year, Second Semester. Two lecture periods per week.

Metallurgy 9.

Metallurgical Laboratory: Laboratory practice in pyrometry; calibration of the thermo-couple with the use of potentiometer; the roasting of ores, noting the formation of sulphate, etc.; the desilverization of base bullion by the Parkes process. Special problems according to the requirements of individual students.

Senior Year, First Semester, Mining Option: Three laboratory hours per week.

Metallurgy 10.

Metallurgical Design: The design of chimneys, cyanide tanks, stamp cams, zinc boxes, mortar box and block, 5 stamp battery, 10-stamp amalgamating concentrating mill, wood construction, dust chamber, copper blast furnace, copper reverberatory furnace, cyanide plant to treat a given ore; data to be

collected from tests in the cyanide laboratory.

Senior Year, Metallurgical Option: Six laboratory hours per week for the second semester.

Metallurgy 11.

Metallurgical Laboratory: Course similar to Metallurgy 11, but amplified.

Senior Year, Metallurgical Option, First Semester: Six laboratory hours per week.

Metallurgy 12.

Metallurgical Laboratory: One upbroken week spent in the metallurgical laboratory on work assigned by the department.

Senior Year, Both Options, Second Semester: Forty-eight hours.

Metallurgy 13.

Metallurgical Laboratory: Testing of ores for the cyanide process. The student will have thorough training in the testing of ores for the purpose of ascertaining the best methods of treatment of a given ore. The data obtained will be used in the work in the drafting room in the course in Metallurgical Design.

Senior Year, Metallurgical Option, First Semester: Nine laboratory hours per week.

Metallurgical Research.

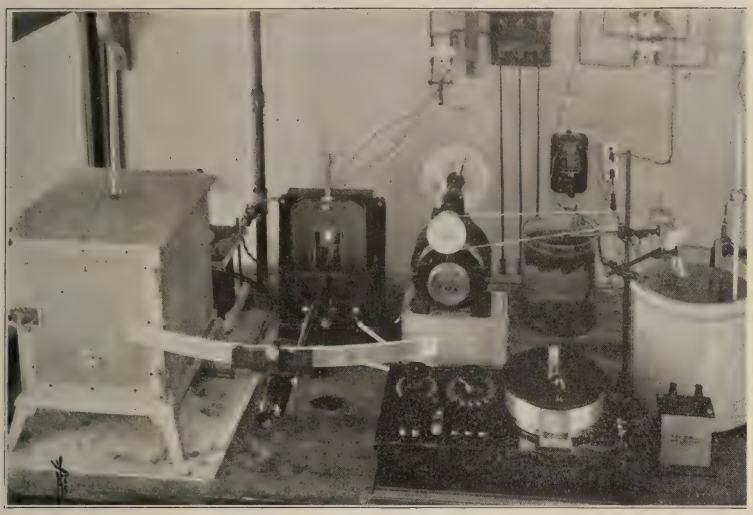
Research Work: Times and fees by arrangement.

Metallurgy 14.

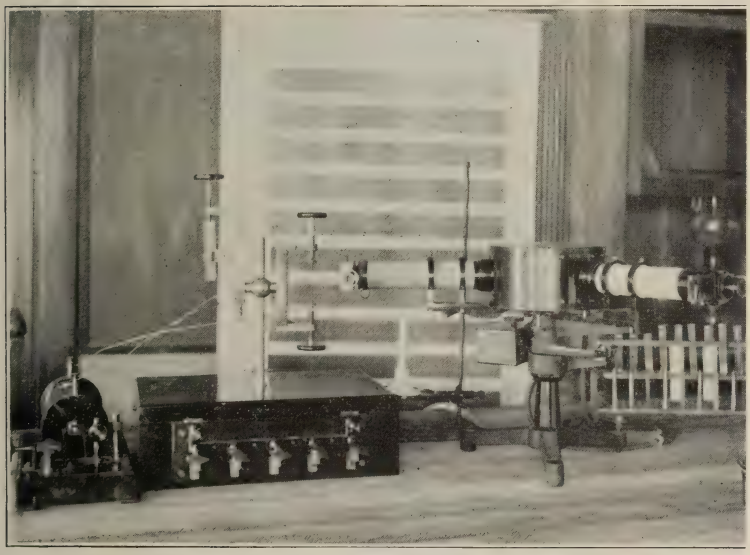
Electro-Metallurgy: Electrolytic processes. Theory, Electrolytic processes for copper, gold silver, lead, nickel and tin.

Electrothermic processes. Theory. The electric furnace for iron and steel, ferro-alloys, carbides, aluminum, zinc, and for miscellaneous purposes.

Senior Year. Metallurgical and Electrical Option, Second Semester: Two hours per week.



ELECTRO-CHEMICAL APPARATUS



SPECTROSCOPE AND ACCESSORY APPARATUS

MINING.

Professor Bochert.

The instruction in Mining is given by lecture courses, illustrated by lantern views, photographs and drawings; by frequent reference to standard works and current literature; by experimental work on various types of ores, carried on in the mining laboratory, and by excursions to nearby mines and mills for the purpose of observing and noting actual conditions of practice.

The department enjoys to an unusual degree, those advantages which naturally accrue from the school's location. Being contiguous to a world famous mineral region, the nearness of large producing mines means much, while the wholesome mining atmosphere in which the student lives, furnishes a never failing supply of food for enthusiasm and interest.

The mining and metallurgical laboratory of the school, which has proven a most valuable adjunct to the work of instruction, is fully equipped with modern appliances of approved design. The operations attendant upon the preliminary treatment of various types of ore are here carried out by the students on a scale approaching commercial practice.

Special field work in mining is held each year in April. A suitable mining locality having been selected, students under the drection of instructors, devote one week to the study of practical mining, both above and below ground, systematic note taking and careful sketching of all principal features being a requirement. Attendance upon this work is obligatory with all members of the Senior class.

The uniform courtesy and good will shown by the management of mining enterprises throughout the region to instructors and students indicates a wholesome regard for the efforts of the department and constitutes one of its most valuable assets.

The following courses are offered by the department:

Mining 1.

Boring: The use of the earth auger, drive pipe, etc., in the boring of holes for wells and for prospecting purposes; the boring of deep holes by the churn drill and drop tool, also by the diamond and other rotary drills; the survey of bore holes; the cost of boring.

Breaking Ground: The excavation of earth and rock in general; hand tools; mechanical earth excavators; rock drills and their use; channelers; coal cutters, steam shovel; dredges, etc.; estimates and costs.

Explosives: Black powder, nitro-glycerine, gun cotton and their derivatives; methods of testing the force of explosion and heat developed; pointing and charging of holes; methods of firing; cost of blasting operations.

Sophomore Year, First Semester: Three lecture periods per week.

Mining 2.

Tunnelling: The driving of mine tunnels and drifts through rocks and through soft or running ground; comparative costs, general discussion of the methods used in driving large tunnels for railroad and other purposes.

Shaft sinking: The sinking of shafts for mining purposes through soil, rock, quicksand and other water-bearing strata, by approved methods; costs of same.

Sophomore Year, Second Semester: Two lecture periods per week.

Mining 3-4.

Ore Dressing: The principles of ore crushing with description of the various types of crushing machinery; screens and the principles of screen sizing; stamp milling and amalgamation; the theory and practical application of the dressing of ores by water currents, including description of the principal forms of classifiers; jigs and the laws of jigging; concentrating tables; slime treatment and the ma-

chinery for its accomplishment; magnetic concentration; concentration by oil; dry concentration; general discussion of the continental and English systems of ore dressing and their American modifcations; the description and study of typical ore dressing plants.

Junior Year, First Semester: Three lecture periods and three laboratory hours per week.

Second Semester: Two lecture periods per week.

Mining 5.

Drainage: Sources of mine water; dams and drainage levels; hoisting of water; Cornish and direct acting pumps; centrifugal pumps; use of compressed air and electricity in pumping operations; special examples and costs.

Transportation: Underground and surface haulage; vehicles and motive power; self-acting and engine planes; tail rope and endless rope systems of haulage; electric and pneumatic haulage; surface tramways and aerial ropeways.

Senior Year, First Semester: Two lecture periods per week.

Mining 6.

Compressed Air and Its Uses: The modern air compressor with accessories and the laws under which it operates; conveyance of compressed air in pipes; effect of altitude; air compression by the direct action of falling water; calculations; costs.

Senior Year, Second Semester: Two lecture periods per week.

Mining 7.

Exploitation: The extraction of mineral by open works, by wells and bore holes; the underground working of veins, bedded deposits and masses by methods best suited to each; conditions affecting the choice of methods; cost of ore extraction.

Supporting Excavations: The use of wood, metal and masonry in the lining of shafts and other excavations, their relative cost, strength and durabili-

ty; the timbering of stopes, stations and other working places underground; the preservation of timber.

Hoisting: Hoisting engines, their construction and chief features; methods of equalizing the load moment on the engine; ropes, cages, skips and safety appliances; gallows frames, pneumatic hoisting; costs.

Senior Year, First Semester. Three lecture periods per week. Mining Engineering Option.

Mining 8.

Ventilation: Natural and induced ventilation; furnaces and fans; friction of air in mines; control of air currents; efficiency of ventilating apparatus.

Lighting: Open lights, safety lamps, the electric and other lights used in underground illumination.

Placer mining: Sluices, riffles, pipe lines, nozzles and hydraulic elevators, their construction and use; river dredging, costs and results.

Senior Year, Second Semester: Three lecture periods per week. Mining Engineering Option.

Mining 9-10.

Design of Mining Plant: The student is given certain data relative to an hypothetical mine, such as maximum depth of hoist, capacity of hoisting, etc., from which he calculates the power needed, selects the type and size of hoisting engine, makes calculations as to the size of reel for flat rope, and drums of different forms, such as to give the best results in the equalization of moment on the engine. He then calculates and designs the gallows frame and shaft house, also other features such as ore bin, mine cage, car or skip.

Senior Year, Mining Engineering Option: Six laboratory hours per week throughout the year.

Mining 12.

Mining Examination: Sampling of ore bodies, estimation of "ore in sight" and valuation of mining properties; forms of report.

Administration: Business management and the principles of employment of labor; organization of mine staff.

Mine Accounting: Organization of corporations and stock companies, with particular reference to mining and metallurgical companies; discussion of systems of mine and mill accounting; keeping accounts with different departments; derivation of cost sheets, etc., accounts of smelting and milling plants, yard books, furnace records, or books, smelting records, etc. General methods of business; buying and selling ores; labor, etc.; organization of the staff of a mining and metallurgical company.

Hygienic Conditions: Surface arrangements for the comfort and convenience of men; ascent and descent by ladders, cage and man engine, and relative economy of different methods; accidents, their causes and prevention; rescue and relief of men; mine fires.

Senior Year, Second Semester: Two lecture periods per week.

Mining 14.

Mr. C. L. Lewis.

Mining Law: During the year Judge C. L. Lewis will deliver a series of lectures before the members of the Senior class, in which he will discuss and exhaustively review the general mining laws with reference to the public lands, embracing among others, the following topics: The early history of mining prior to the General Laws of Congress; the General Mining Laws of the United States and Territories; Mining Districts, their origin, how organized and the customs, rules and regulations of miners; lands subject to location and who can locate, the proper location of lode claims; the proper location of placer claims; patent proceedings; timber and stone lands in the mining states, and special laws applicable thereto.

Senor Year, Second Semester: One lecture period per week for twelve weeks.

MATHEMATICS.

Professor McLaury.

The engineer, from the very nature of his work, must of necessity meet many difficult problems. His success will depend on his ability to solve them. As it is impossible to tell in advance just what experience a given student will meet, that course is best which results in mental power. It is not a question of what the student has done, but what he can do. Has he a comprehensive grasp of the subject; has he thoroughly mastered the principles; can he apply these principles to kindred subjects?

The aim of this department will be to give the student a thorough knowledge of the principles of mathematics so as to enable him to apply them readily to the solution of practical problems. Original work is encouraged, and an effort is made to cultivate the habit of exact, logical reasoning, and to stimulate independent thought. Both rapidity and accuracy are expected in all mathematical work. The great importance of mathematics as the basis of a scientific education justifies the requirement of all elementary courses, as a prerequisite to the engineering courses.

In the following courses, particular pains will be taken to explain all the more difficult algebraic processes as they occur. Several subjects in higher algebra will be discussed, each at the point where it is required for immediate application. Students who have not studied algebra for a year or more, should make a careful review before entering school, for a thorough knowledge of the elements of algebra is essential to the successful completion of all subsequent courses. All students who have had less than two years of algebra should take algebra with their Freshman work.

Classes will be provided for students who are deficient in algebra or solid geometry.

Mathematics 7.

Trigonometry: Plane, analytical and spherical. Considerable attention is paid to the consistent and

scientific development of the fundamental conventions and definitions, and to the derivation and transformation of trigonometric expressions. Many practical problems are solved.

Freshman Year, First Semester: Five lecture periods per week for sixteen weeks.

Text Book: Phillips & Strong's Trigonometry.

Mathematics 8.

Analytic Geometry: This course includes the following subjects: Loci, straight lines; transformation of co-ordinates; circles; conic sections; the general equation of the second degree and higher plane curves.

The theory will be developed by lectures.

Freshman Year, Second Semester: Five lecture periods per week for eighteen weeks.

Text Book: Nichol's Analytic Geometry.

Mathematics 9.

Differential Calculus: The text book work is supplemented by lectures. This course will include a short course in solid analytic geometry, based on Nichol's Analytic Geometry.

Sophomore Year, First Semester: Five lecture periods per week.

Text Book: Granville, Differential and Integral Calculus.

Mathematics 10.

Differential and Integral Calculus: This course is a continuation of the last course and will include the most of the work in Granville's Calculus.

Sophomore Year, Second Semester: Five lecture periods per week.

Mathematics 11.

Differential Equations, Junior Year. Firse Semester, Electrical Engineering Course: Three lecture periods per week.

Text Book: Differential Equations by D. A. Murray.

ENGLISH.

Professor McLearie.

The aim of this department is to give the student a command of good idiomatic English and to aid him in the development of the art of expression. Special emphasis is laid upon the importance of good composition in technical work. Attention is called to the absolute necessity that every professional man should be able to express his thoughts with clearness and accuracy.

English 9.

The Elements of Effective Writing: This course gives both theoretical and practical instruction. The theory is taught by class room work based on standard text books. The practice is obtained by exercises, written in the class room, and by weekly themes. At least one theme a week is required, and every theme is returned to the student to be revised or rewritten.

Freshman Year, First Semester: Four lecture periods per week.

Text Books: Canby's English Composition; Berkeley's College Course in Writing from Models; Steeves and Ristine's Representative Essays in Modern Thought.

English 10.

This course supplements the work of the first semester by giving further practice in narrative, expository and argumentative writing. A study is made of the works of such authors as will aid in practical composition work. Three themes are required, each containing from 800 to 1,000 words. There will be a conference on each theme.

Freshman Year, Second Semester: Four lecture periods per week.

*Sociology.

This course is introductory in character. It consists of lectures and required readings on the con-

tents and methods of Sociology. The physical. biological and psychological aspects of social evolution will be discussed. As far as possible a number of modern social problems will be considered.

Junior Year, First Semester: Three lecture periods per week.

Text Book: Blackmor and Gillin's Outline of Sociology.

***Economics.**

This course will give a brief survey of the principles of economics. It will also include discussions of the more important contemporary economic and social problems.

Junior Year, Second Semester: Three lecture periods per week.

Text Book: Ely's Outline of Economics.

*Many up-to-date reference books are available to students selecting this course.

MODERN LANGUAGES.

Miss Thomae.

This deparment is open to all students desiring to become acquainted with the scientific knowledge of a language as well as its literary culture. French and German have special importance in the study of all sciences, and the rapidly developing trade relations with Central and South American countries have made an increasing demand for Spanish. Courses are offered for two or more years in each language. A rapid and systematic study of the essentials of grammar is emphasized and special attention is given to acquiring facility in conversing.

French 1-2.

Elementary French: This course is intended for those who begin French at the School of Mines. Its aim is to enable the student to read ordinary French with ease, to undertsand to some extent the language when spoken, and to form simple sentences, both oral and written.

Freshman Year, First and Second Semester. Five lecture periods per week.

Texts and Readings: Fraser and Squairs' Grammar; Composition from Francois; Halevy, L'Abee' Constantin; Hugo, Les Miserables.

French 3-4.

Advanced Prose Composition: This course is conducted mainly in French. The work is based upon selected texts and drill is also given in the writing of French themes and letters.

Sophomore Year, First and Second Smester. Five lecture periods per week.

Readings: Labiche and Martin, Le Voyage de M. Perrichon; Dumas, La Tulipe Noire.

German 1-2.

Elementary German: This course affords practice in pronunciation and in memorizing short selections, and systematic drill in grammar with special reference to syntax.

Freshman Year, First and Second Semester. Five lecture periods per week.

Readings: Gronow, Jung Deutschland; Guerber, Marchen and Erzahlungen; Storm, Immensee.

Not given during 1918-'19.

German 3-4.

Advanced Prose Composition: Grammar is reviewed by means of composition and conversation. Prose of advanced nature and literary masterpieces are read and talks in German are given on subjects pertaining to German life. The acquirement of an ability to understand spoken German and the attainment of a practical vocabulary are insisted upon.

Sopohomore Year, First and Second Semester. Five lecture periods per week.

Texts and Readings: Vos, Composition; Wildenbruch, Edle Blut; Wells, Drie Kleine Lustspiele; Schiller, Wilhelm Tell.

Not given during 1918-'19.

Spanish 1-2.

Elementary Spanish: This course aims to give a knowledge of the essentials of Spanish grammar, the ability to read ordinary Spanish with ease, and some practice in conversation.

First and Second Semester. Five lecture periods per week.

Text and Readings: DeVitis, Spanish Grammar; Roessler and Remy; Geddes, Padre Isla's Lesage's Gil Blair.

Spanish 3-4.

Advanced Spanish: Grammar is reviewed by means of composition and conversation. Modern novels and plays are read. This course is a continuation of Spanish 1-2 but more advanced in character.

First and Second Semester. Five lecture periods per week.

Readings: Galdos, Marianela; Hill, Spanish Short Stories.

BIOLOGY.

Associate Professor Talbot.

All courses in biology are cultural but groups of them give a broad foundation for scientific agriculture, forestry, sanitation, medicine and other biological professions. They are of particular service in preparing the student for certain of the geological studies given in the Engineering courses and are open to all students of college rank.

Biology 7.

General Biology: This is an introductory course consisting of lectures, conferences and laboratory work. Influence of environment, heredity, variation, structure, life activities, plant and animal organisms in relation to each other, et cetera, are some of the features of the work.

Three lecture periods and two laboratory hours per week for one semester.

Text Book: Sedgwick and Wilson, General Biology.

Biology 8-9.

General Botany: The aim of this course is to give the student a general summary of the functions, structure and inter-relations of plants. The first semester is devoted to the lower plants, algae, moss forms, and ferns. In the second semester frequent field trips are taken for the study of seed plants. A number of our early native plants are identified.

First and Second Semester. Three lecture periods and two laboratory hours per week.

Text Book: Atkinson-College Botany.

Biology 10-11.

Zoology: In this course a detailed study of typical representative forms of the main groups is made. Much emphasis is placed upon progressive development, form, structure, activities, life history, heredity and ecology.

First and Second Semester: Three lecture periods and two laboratory hours per week.

Text Books: Hegner's College Zoology, Sigerfoos' Laboratory Manual.

Biology 12.

Physiology: Recitations with laboratory study of skeleton, manikin, anatomical models, prepared slides and dissection of domestic animals.

Four lecture periods per week for one semester.

Text Book: Martin's Human Body.

Biology 13.

Evolution: The aim of this course is to present to the student the processes of evolution as they are so far understood. Animals and plants serve as illustrative material. Some of the topics considered are species forming heredity, mutation, variation, degeneration, instinct and reason.

One Semester. Three lecture periods per week.

Text Book: Jordan and Kellog's, Evolution and Animal Life.

SHOP WORK.

Mr. Coursen.

The aim of this department is to give the student a theoretical knowledge in the class room of the use of tools, with a practical understanding and care of the mechanical equipment in a modern mill.

Shop Work 1-2.

Wood Work: The work in the wood shop aims to train the student in the use of wood-working tools and machinery and to familiarize him with the properties of the common woods. Each student is furnished an outfit of bench tools which he is taught to keep sharp and in good condition. The use of simple tools is first learned and this is followed by work on the turning lathe, universal wood-worker, etc. The entire course is bent toward the elimination of awkwardness and to enable the student to command the best use of his hands.

Six laboratory hours per week throughout the year.

Shop Work 3-4.

Forge and Machine Shop Work: This course begins with simple exercises in upsetting, bending, twisting, punching and welding. The work gradually becomes more difficult, such as making eye-bolts, chains, and tongs. Tool-making is then begun by making screw-drivers, hammers and chisels, to be used later in the machine shop. Forging includes the care of blacksmith's fire and tools, the study of forging, tempering, welding, and case hardening. The instructor makes the student familiar with the best grade of steel to be used for any required purpose, and the correct shape and temper necessary for the best work in cutting iron, steel, brass, and stone. The machine shop work includes molding, casting, use of the oxy-acetylene welding apparatus, the operation of the drill press, lathe, shaper, buffer and hack saw. Practice work in the machine shop concludes this course.

Three laboratory hours per week throughout the year.

Shop Work 5-6.

Pattern Making: The work in pattern making requires the construction of patterns for machines, or for parts of machines. Pattern making is studied in its relation to molding; the practical construction of patterns to prevent warping and distortion; the making of special patterns, cores and core boxes, introducing draft shrinkage, finish and the technical appliances and usages of modern pattern work.

Three laboratory hours per week throughout the year.

Shop Work 7-8.

Winding Laboratory: This course is designed to be of particular service to students taking the Electrical Engineering Course.

Junior Year: Three laboratory hours per week throughout the year.

LIST OF STUDENTS, 1917-18.

Senior Class.

Clark, Edwin.....Watertown, S. D.
Deutsch, Harry.....Rapid City, S. D.
Newbowers, Frank J.....Rapid City, S. D.
Stout, Herbert A.....Rapid City, S. D.
Wong, Yu-Chih .....Hunan, China

Junior Class.

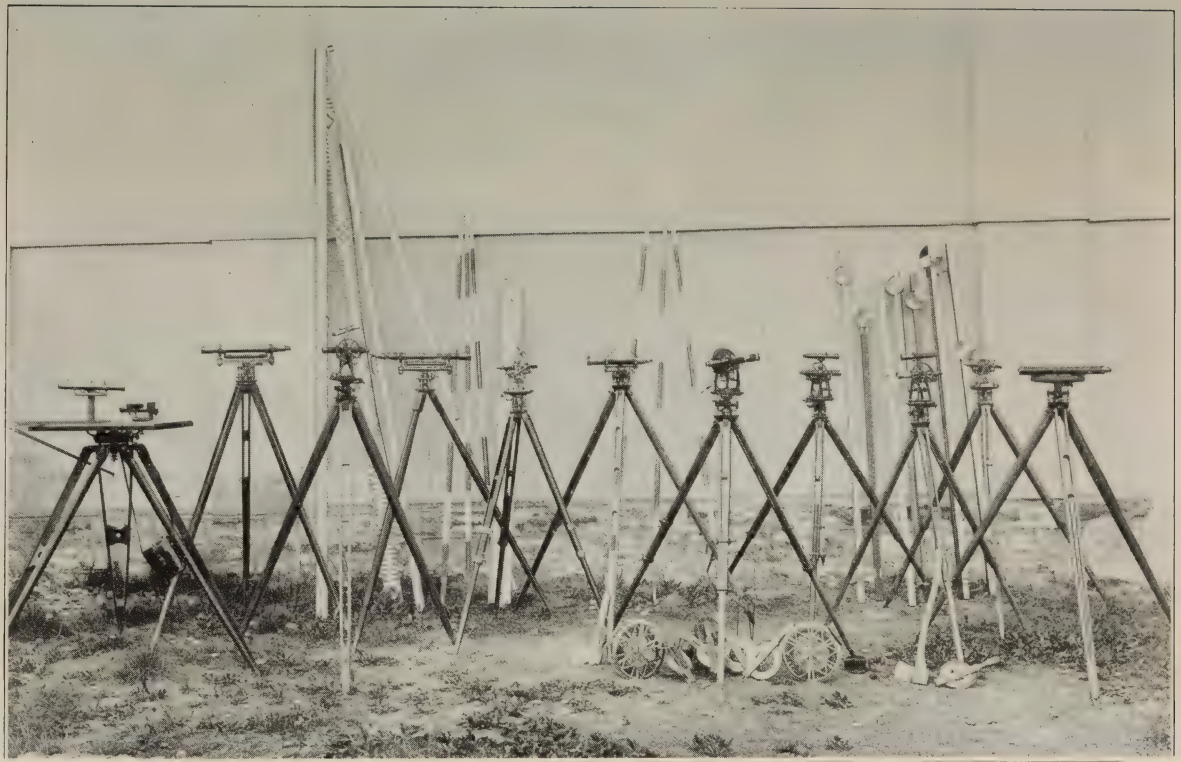
Bentley, Charles.....Trojan, S. D.
Gantz, Gardner.....Rapid City, S. D.
Hall, R. Julius.....Lead, S. D.
Jagoe, Leo J.....Atlanta, Ga.
Mara, Hubert.....Mellette, S. D.
Nelson, Harold .....Rapid City, S. D.

Sophomore Class.

Enos, George .....Cottonwood, S. D.
Kalb, J. Lorenz.....Rochester, Minn.
Mallmann, Adolph .....Farmingdale, S. D.
Mechtle, Helen .....Rapid City, S. D.
Parsons, Marie.....Rapid City, S. D.
Parsons, Merle.....Rapid City, S. D.
Schrader, Huston.....Rapid City, S. D.
Waldschmidt, William.....Lead, S. D.
Wilson, Sidney.....Deadwood, S. D.

Freshman Class.

Aikman, William .....Hermosa, S. D.
Babcock, Harold.....Belle Fourche, S. D.
Babington, Morgan.....Whitewood, S. D.
Bruce, Marion.....Wall, S. D.
Chapman, Leslie.....Lead, S. D.
Chase, Isaac.....Rapid City, S. D.
Christensen, Harold.....Faribault, Minn.
Cook, R. Lyle.....Kimball, S. D.
Coursen, Louise.....Rapid City, S. D.
Crabtree, Hampton.....Rapid City, S. D.
Craven, Thomas.....Belle Fourche, S. D.
Elliott, Herbert.....Pueblo, Colo.



Gantz, Frank E.....Rapid City, S. D.
Hammerquist, Charles.....Farmingdale, S. D.
Harris, Donald.....Highmore, S. D.
Harvey, William.....Rapid City, S. D.
Hayes, Joel.....Rapid City, S. D.
Hoyt, Julia.....Rapid City, S. D.
Jacobs, Morris .....Lead, S. D.
Lintz, Mark.....Hermosa, S. D.
March, Raymond.....Rapid City, S. D.
Perrigo, Harry.....Hermosa, S. D.
Platt, Charles.....Caputa, S. D.
Teall, Homer.....Philip, S. D.
Van Meter, Wilmer.....Rapid City, S. D.
Wurtsbaugh, C. Guy.....Irwin, Iowa

Special Students.

Allen, Edward S.....Rapid City, S. D.
Blake, Pauline .....Fargo, N. D.
Brown, Lillian G.....Rapid City, S. D.
Daugherty, Mae.....Rapid City, S. D.
Gray, Claude E.....Rapid City, S. D.
Groethe, Amos.....Rapid City, S. D.
Hartgering, James.....Rapid City, S. D.
Hood, A. Bristow.....Rapid City, S. D.
Jenney, Adelle .....Milwaukee, Wis.
Jeffers, Ethel.....Rapid City, S. D.
Jeffers, George.....Rapid City, S. D.
Karr, George.....Rapid City, S. D.
McMichael, Mattie.....Rapid City, S. D.
Miller, Florence.....Rapid City, S. D.
Preston, Anna.....Rockford, Ill.
Reeves, Edith.....Rapid City, S. D.
Robins, Joseph.....Rapid City, S. D.
Robinson, William E.....Rapid City, S. D.
Rose, Harry.....Rapid City, S. D.
Sherman, James.....Rapid City, S. D.
Spayde, Estelle.....Rapid City, S. D.
Swander, Edward.....Rapid City, S. D.
Swanson, Elvina.....Rapid City, S. D.
Taylor, Iva.....Rapid City, S. D.
Uecker, William C.....Rapid City, S. D.
Watson, James.....Rapid City, S. D.
Yeager, V. C.....Rapid City, S. D.
Youngberg, George E.....Rapid City, S. D.

Preparatory Students.

Bump, Almyr ..... Scenic, S. D.
Clark, Naoma ..... Watertown, S. D.
Cordes, Richard ..... Rapid City, S. D.
Crabtree, DeLance ..... Rapid City, S. D.
Dale, William ..... Rapid City, S. D.
Edzards, Clifford ..... Rapid City, S. D.
Gillespie, Raleigh ..... Oral, S. D.
Haedt, Julius ..... Rapid City, S. D.
Hart, Clifford ..... Rapid City, S. D.
Hawley, George ..... Interior, S. D.
Hearn, Miles ..... Rapid City, S. D.
Hoffman, Edgar ..... Keystone, S. D.
Hoffman, Ernest ..... Keystone, S. D.
Johnson, Edgar ..... Sturgis, S. D.
Kennedy, Milo ..... Fairburn, S. D.
McCormick, Wade H ..... Rapid City, S. D.
Mahoney, Raymond ..... Rapid City, S. D.
Marsh, Corbin ..... Rapid City, S. D.
Marsh, Ralph ..... Rapid City, S. D.
Morris, Wesley ..... Wasta, S. D.
Mulcahy, Edward ..... Rapid City, S. D.
O'Harra, Paul ..... Rapid City, S. D.
Olsen, Lester ..... Philip, S. D.
Platt, Isaac ..... Caputa, S. D.
Sands, William ..... Rapid City, S. D.
Saxer, Clarence ..... Rapid City, S. D.
Smith, Carroll B ..... Rapid City, S. D.
Sweeney, Thomas ..... Rapid City, S. D.
Westover, Maurice ..... Fairburn, S. D.
Westover, John ..... Fairburn, S. D.
Wood, John ..... Chicago, Ill.

ALUMNI.

Alder, Alfred Jr., B. S., in Metallurgical Engineering 1913; in military service (engineering corps); formerly Metallurgical Chemist Buenos Ayres, Argentina.

Alger, Otille Behrens, B. S. Custer, S. D.

Anderson, Amil Abner, B. S. in Metallurgical Engineering 1913; Met. E. 1917; Superintendent Elkhorn Tungsten Co., Hill City, S. D.

Anderson, Frank, B. S. in Mining Engineering, 1917; Mining Geologist Matahambre Mining Co., Matahambre, Pinar Del Rio, Cuba.

Anderson, William L., B. S. in Metallurgical Engineering, 1911; Met. E., 1914; Metallurgical Engineer, Rochester, Nevada.

Anderson, O. Allen, B. S. in Mining Engineering, 1905; E. M., 1907; Superintendent August Mining Co., Landusky, Montana.

Arentz, Samuel S., B. S. in Mining Engineering, 1904; E. M., 1906. Mining Engineer, Dooley Building, Salt Lake City, Utah.

Bennett, Richard T., B. S. in Mining Engineering, 1910; in Military Service. Formerly Electrician, Minneapolis, Minn.

Betterton, Jesse O., B. S. in Metallurgical Engineering, 1909; Met. E., 1912. Chemist American Smelting and Refining Co., Omaha, Nebraska.

Bochert, William C., B. S. in Mining Engineering, 1914; E. M., 1917. Professor of Mining, South Dakota School of Mines, Rapid City, S. D.

Booth, Lionel E., B. S. in Metallurgical Engineering, 1915. In Military Service. Formerly in Testing Laboratory of Anaconda Copper Co., Anaconda, Mont.

Brooks, Floyd, B. S. in Metallurgical Engineering, 1911. Canadian Military Service (Engineering Corps). Formerly Mining Engineer Sudbury District, Worthington, Ontario.

Bryant, Frank, B. S. in Mining Engineering, 1907; E. M., 1911. Maiden, Mont.

Clevenger, G. Howell, B. S. in Mining Engineering, 1901; E. M., 1908; A. M., Columbia University. Director of Co-operative Experimental Work, Bureau of Mines, Golden, Colorado.

Coolidge, Edwin, B. S. in Mining Engineering, 1906; E. M., 1911. General Manager St. Paul-Montana Mining Co., Maiden, Mont.

Cooledge, Cyril, B. S. in Mining Engineering, 1908; E. M., 1912. In Military Service (Engineering Corps). Formerly Mining Engineer, Tyrone, New Mexico.

Coolidge, Roy R., B. S. in Mining Engineering, 1909; E. M., 1911. Chemist American Smelting and Refining Co., Omaha, Neb.

Cragin, Rodney, B. S. in Metallurgical Engineering, 1916. In Military Service. Formerly with the American Tin and Tungsten Co., Hill City, S. D.

Cornell, Wharton, B. S. in Mining Engineering, 1907. 1711 Rodney Street, Wilmington, Del.

Cremer, Frank, B. S. in Mining Engineering, 1917. Engineering Department, Valier Land and Water Co., Valier, Mont.

Curran, Harry T., B. S. in Mining Engineering, 1906; E. M., 1908. Superintendent Argo Reduction Co., Idaho Springs, Colo.

Dennis, Paul, B. S. in Metallurgical Engineering, 1916. In Military Service. Formerly with Socorro Mining Co., Mongollon, New Mexico.

Dickey, Samuel C., B. S. in Mining Engineering, 1912. Mining Engineer Elkhorn Tungsten Co., Hill City, S. D.

Eddy, John, B. S. in Mining Engineering, 1910. Helena, Montana.

Ehle, Chester G., B. S. in Mining Engineering, 1911. Water Engineer, City Hall, Portland, Oregon.

Eldridge, Robert B., B. S. in Metallurgical Engineering, 1914. Metallurgical Engineer, Lakewood, Colo.

Ellerman, Otto, B. S. in Mining Engineering, 1907; E. M., 1911. State Mine Inspector, Lead, S. D.

Elliott, John Wing, B. S. in Mining Engineering, 1910. Manager Columbus Auto Co., Columbus, Neb.

Fahrenwald, Frank A., B. S. in Mining Engineering, 1912; E. M., 1914, South Dakota School of Mines; M. S., Pennsylvania State College; Ph. D., University of Michigan. Consulting Metallurgist, 1706 Glenmount Ave., Cleveland, Ohio.

Fahrenwald, Arthur W., B. S. in Metallurgical Engineering, 1914; Met. E., 1916. Metallurgical Engineer Copper Queen Mining Co., Bisbee, Arizona.

Farnham, Lloyd L., B. S. in Mining Engineering, 1914. Superintendent HomeLode Mine, Silver City, S. D.

Feigel, Carrie, B. S. Deputy Clerk of Courts, Rapid City, S. D.

Fleichman, Leo, B. S. in Mining Engineering, 1914. Mine Superintendent, Rowena, Colo.

Flower, George Earl, B. S. in Metallurgical Engineering, 1910. Constructing Engineer, Cleveland Water Filtration Station, Cleveland Ohio. Address, 1436 W. 110th Street.

Gains, William, B. S. in Mining Engineering, 1906. Mill Superintendent, Beaver Creek Mining Co., Dodson, Montana.

Gates, Clyde E., B. S. in Mining Engineering, 1915. Superintendent of Schools, Kensal, N. D.

Goodner, Ivan E., B. S. in Metallurgical Engineering, 1908. Assistant Division Engineer, Miami Conservancy District, Dayton, Ohio.

Hall, Arthur E., B. S. in Mining Engineering, 1904; Met. E., 1906. Superintendent American Smelting and Refining Co., Omaha, Neb.

Halley, James, Jr., B. S. in Mining Engineering, 1905. Cashier Keystone Bank, Keystone, S. D.

Hancher, John W., B. S., M. S., South Dakota School of Mines; A. M., Mount Union College; LL. D., Simpson College. Associate Secretary of the Board of Education of the Methodist Episcopal Church, 150 Fifth Avenue, New York City.

Hartgering, J. M., B. S. in Metallurgical Engineering, 1913. With Clarence W. Hubble, Consulting Engineer, Detroit, Mich.

Hebblethwaite, L. L., B. S. in Mining Engineering, ing, 1908. Evanston, Ill.

Henton, Hugh M., B. S. in Metallurgical Engineering, 1913. Instructor in Metallurgy, Case School of Applied Science, Cleveland, Ohio.

Hill, Robert S., B. S. in Mining Engineering, 1914. Diamond Prospector, care Forminiere Mission, Kasai, Tshikapa, Congo Belge., via Boma and Luebo.

Hill, Joseph H., B. S in Mining Engineering, 1916. New Consolidated Copper Co., Ruth, Nevada.

Hopkins, Max, B. S. in Mining Engineering, 1901. Vice President and Sales Manager, Electra-Texas Oil Lands Co., Milwaukee, Wis.

Hvistendahl, Eli A., A. B. University of South Dakota; B. S. in Mining Engineering, 1909. South Dakota State School of Mines. Chemist American Smelting and Refining Co., Omaha, Neb.

Ives, Glen P., B. S. in Mining Engineering, 1908. E. M., 1912. General Manager, Compani de Mines, Cachinal, Taltal, Chile.

Jeffries, Zay, B. S. in Mining Engineering, 1910; Met. E., 1914. Graduate Student in Metallography, Harvard University.

Jones, H. W., A. B. University of South Dakota; B. S. in Mining Engineering, 1909, South Dakota School of Mines. Farmer, Rapid City, S. D.

Ledyard, Lewis W., B. S. in Metallurgical Engineering, 1909. Mining Engineer, Teck-Hughes Gold Mines, Kirkland Lake, Ontario.

Marshall, Willard C., B. S. in Mining Engineering, 1909. Rapid City, S. D.

Matson, Bernard, B. S. in Mining Engineering, 1907. U. S. Assay Office, New York, N. Y.

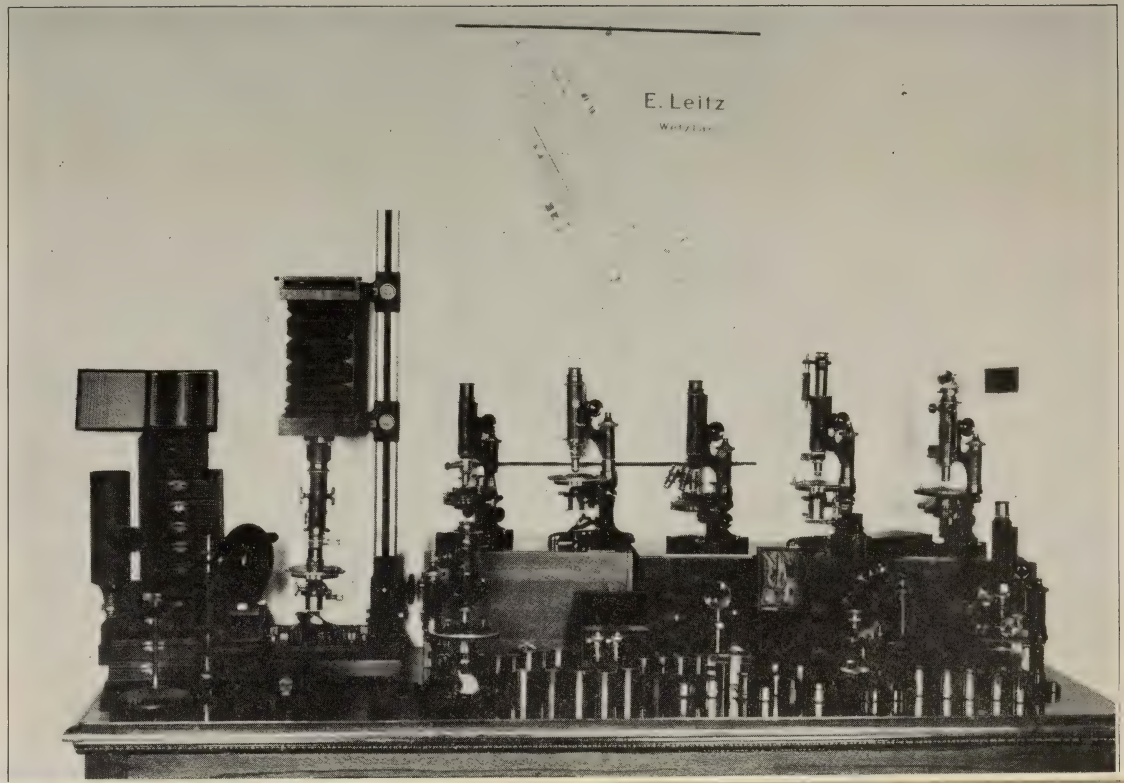
McCauley, Willard J., B. S. in Mining Engineering, 1914. Mining Engineer, Ray, Ariz.

Meents, R. O., B. S. in Mining Engineering, 1914. Mining Engineer, Miami, Ariz.

Mellinger, Lloyd, B. S. in Mining Engineering, 1907. Assayer and Chemist, Martinez, California.

Morris, Milton, B. S. in Mining Engineering, 1907. Assayer, Frawley, Colo.

Mosier, Peter, B. S. in Mining Engineering, 1912. In Military Service (Engineering Corps). Former-


E. Leitz

ly Assistant Superintendent Mary Murphy Mining Co., Romley, Colo.

Muhmel, Fred J., B. S. in Mining Engineering, 1911. Scotland, S. D.

O'Brien, B. D., E. E. Rose Polytechnic, 1896; B. S. in Metallurgical Enginereing, 1906; E. M., 1910, South Dakota School of Mines. Sundance, Wyoming.

O'Harra, B. Marvel, B. S. in Metallurgical Engineering, 1915. Chemist American Smelting and Refining Co., Omaha, Neb.

Ossa, Ignacio Diaz, B. S., in Metallurgical Engineering, 1908. President School of Mines of Serena, La Serena, Chile.

Overpeck, Areli C., B. S. in Mining Engineering, 1902; E. M., 1906. Mining Engineer, Kingman, Ariz.

Overpeck, Hollis W., B. S. in Mining Engineering, 1905; E. M., 1907. Mine Superintendent, Oliver Iron Mining Co., Buhl, Minn.

Overpeck, Lem. S., B. S. in Mining Engineering, 1908. With Frazier and Johnson Commission Co., South Omaha, Neb.

Penhoel, Louis, B. S. in Mining Engineering, 1906. 524 Wesley Roberts Building, Los Angles, Cal.

Poznansky, Benjamin, B. S. Western Representative Gerhard-Mennen Chemical Co., Los Angeles, Cal.

Price, Virgil T., B. S. in Metallurgical Engineering, 1917. Chemist American Smelting and Refining Co., Omaha, Neb.

Pryer, W. Christy, B. S. in Metallurgical Engineering, 1914. In Testing Laboratory Anaconda Copper Co., Anaconda, Mont.

Quinney, Elwin H., B. S. in Mining Enginerieng, 1911; Met. E., 1913. Assistant State Engineer, Pierre, S. D.

Read, Herbert, B. S. in Mining Engineering, 1909; E. M., 1911. Mill Superintendent Socorro Mining Co., Mogollon, New Mexico.

Read, J. Burns, B. S. in Mining Engineering, 1906; E. M., 1908. Assistant Professor of Mining, Case School of Applied Science, Cleveland, Ohio.

Robinson, Eva, B. S., A. M. Professor of Home Economics, University of South Dakota, Vermillion, S. D.

Sargent, Arthur E., B. S. in Metallurgical Engineering, 1910. General Manager, Mogul Mine, Terry, S. D.

Saville, Joseph H., B. S. in Metallurgical Engineering, 1910; E. M., 1912. Wilmington, Del.

Seiter, Herbert, B. S. in Mining Engineering, 1906. Merchant, Albion, Neb.

Smith, Earl Van L., B. S. in Mining Engineering, 1906. Akron, Ohio.

Smith, Elwyn, B. S. in Metallurgical Engineering, 1916. Research Assistant, Bureau of Mines, St. Paul, Minn.

Sparling, W. G., B. S. in Mining Engineering, 1908. Rapid City, S. D.

Stoner, John William, B. S. in Mining Engineering, 1910. City Engineer, Lead, S. D.

Stowell, George E., B. S. in Mining Engineering, 1914. Assistant Mining Engineer, Bureau of Mines, 4335 12th Avenue, Seattle, Washington.

Thiel, Arthur, B. S. in Metallurgical Engineering, 1915. In Military Service. Formerly in Testing Laboratory Anaconda Copper Co., Anaconda, Montana.

Thompson, C. C., B. S. in Mining Engineering, 1902. E. M., 1906. United States Deputy Mineral Surveyor for Nevada, Goldfield, Nev.

Van Nuys, C. C., A. B., Yankton College; B. S. in Mining Engineering, 1907; E. M., 1910, South Dakota School of Mines; A. M., Columbia University. Professor of Physics, Colorado School of Mines, Golden, Colo.

Wells, Leon Peck, B. S. in Mining Engineering, 1907. Vice President Aberdeen Wholesale Grocery Co., Aberdeen, S. D.

Wetherald, Frederick H., B. S. in Mining Engineering, 1906; Met. E., 1914. 39 Eldom Street, Dorchester, Mass. With Stone & Webster, Engineers, Boston.

West, Elmer W., B. S. in Mining Engineering, 1904; E. M., 1906. Chemist, 138 East Rose St., Stockton, California.

Wheelock, Harry Ellis. B. S. in Mining Engineering, 1910. General Manager Socorro Mining Co., Mogollon, New Mexico.

Whitemore, Charles. B. S. in Mining Engineering, 1907. Hardware Merchant, Canton, S. D.

Whytock, Peter, B. S. in Mining Engineering, 1906. Mining Engineer, Sutro, Nevada.

Willard, Clarence G., B. S. in Metallurgical Engineering, 1911; Met. E., 1914. Metallurgist, Marcy Mill Department, Mine & Smelting Supply Co., Denver, Colo.

Winters, Fred W., B. S. in Mining Engineering, 1908. E. M., 1911. Lake City, Minn.

Winsor, Frank H., B. S. in Metallurgical Engineering, 1911. Mitchell, S. D.

Wolcott, Guy E., B. S. in Mining Engineering, 1904. Mining Engineer, Cripple Creek, Colo.

Woodard, D. C., B. S. in Mining Enginering, 1908. Assayer and Metallurgist, La Serena, Chile.

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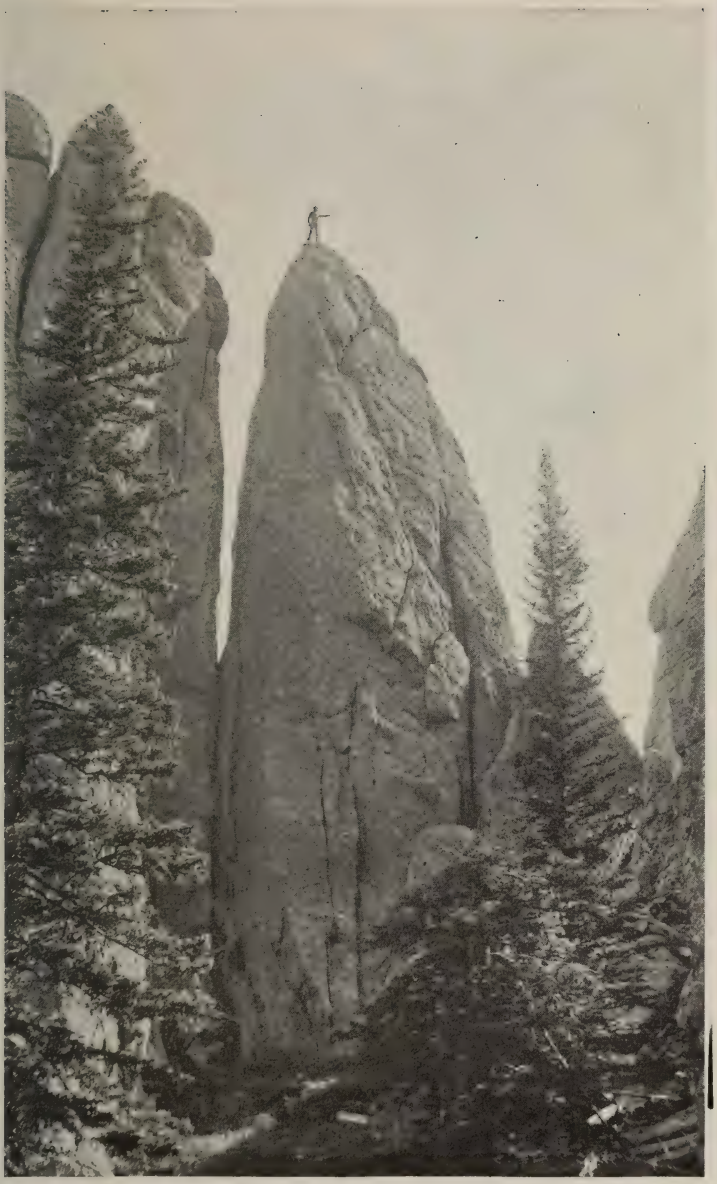

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ANNUAL CATALOG 1918-1919

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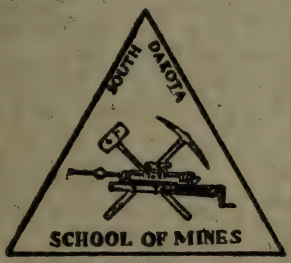

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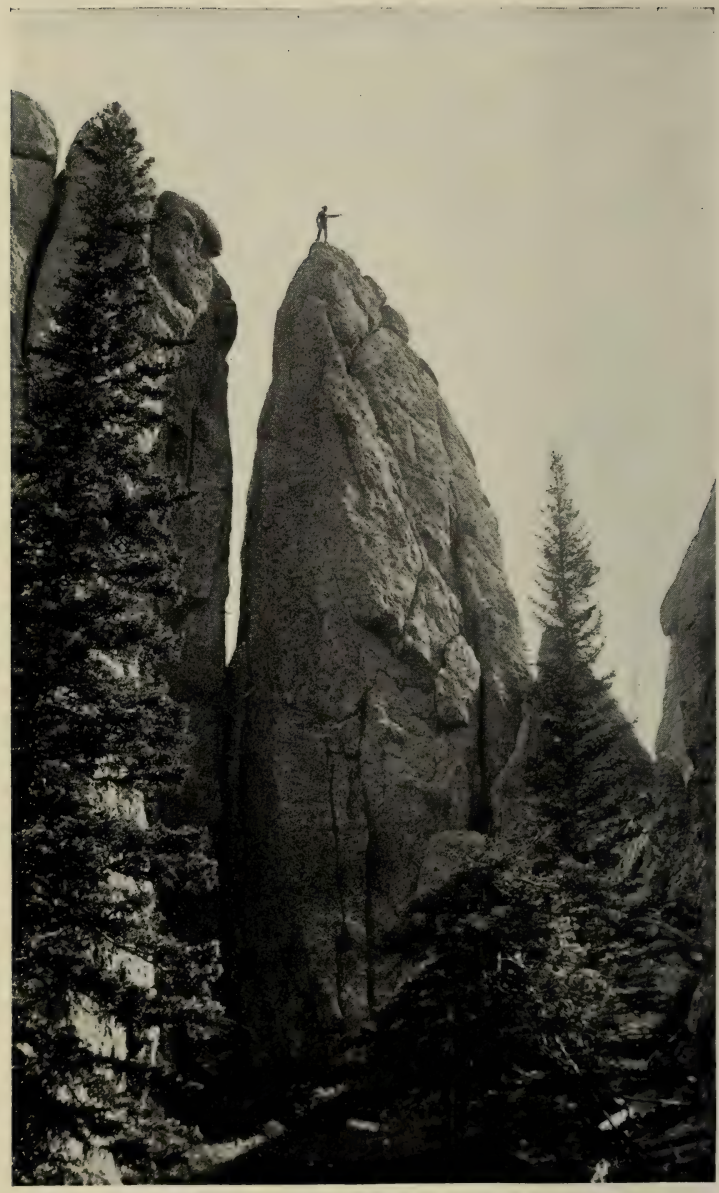


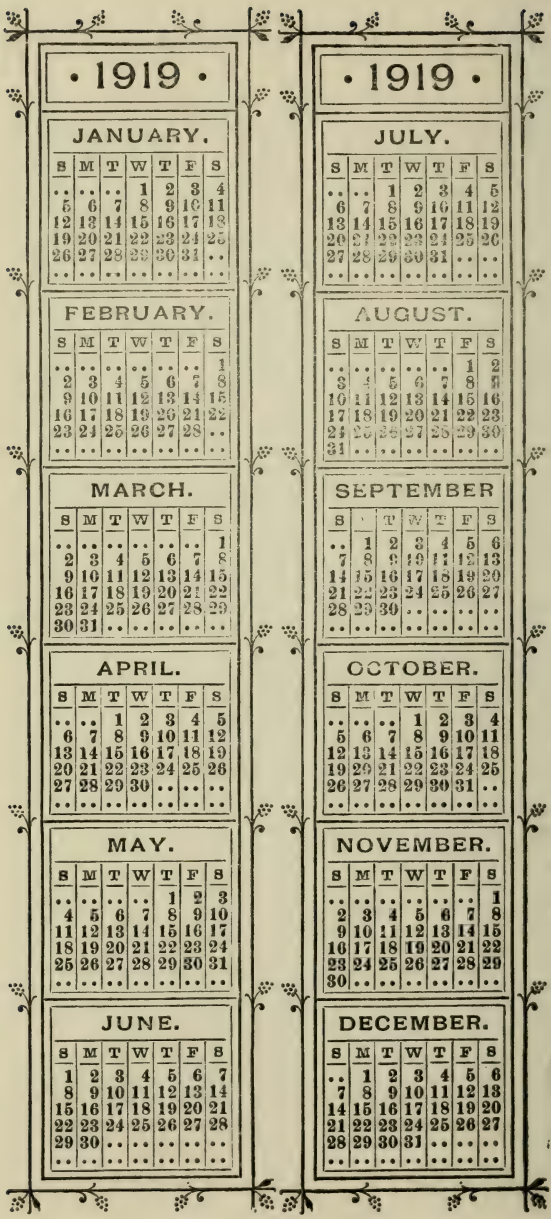
Harney Needles near Sylvan Lake.

South Dakota State School of Mines

ANNUAL CATALOG 1918-1919

With Announcements for 1919-1920

RAPID CITY, SOUTH DAKOTA
AUGUST 1919



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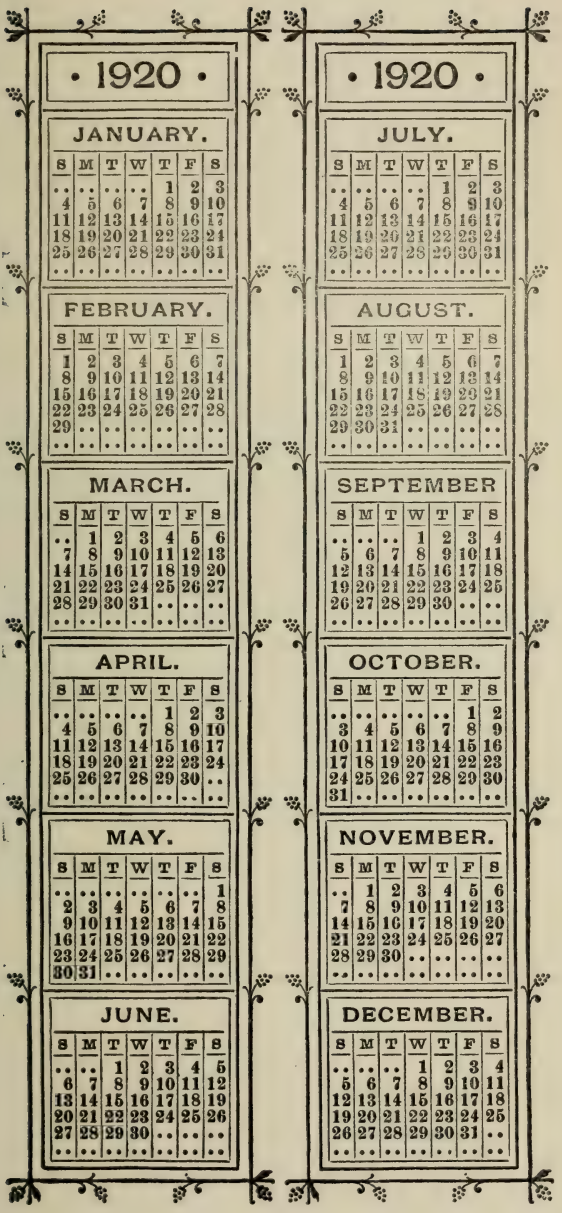
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COLLEGE CALENDAR

1919

Sept. 16, Tuesday.....Registration.
Sept. 17, Wednesday.....First Semester begins.
Nov. 27, Thursday.....Thanksgiving Recess begins.
Dec. 22, Monday.....Christmas Vacation begins.

1920

Jan. 3, Saturday.....Christmas Vacation ends.
Jan. 26 to Jan. 31.....Midyear Examinations.
Jan. 31, Saturday.....First Semester ends.
Feb. 2, Monday.....Second Semester begins.
Feb. 22, Sunday.....Washington's Birthday.
March 30 to April 4.....Annual Field Trips.
May 24, Sunday.....Baccalaureate Sermon.
May 25, Monday.....Final Examinations begin.
May 28, Thursday.....Commencement and Conferring of Degrees.
May 29, Friday.....Final Examinations end.

REGENTS OF EDUCATION

Members of the Board.

THEODORE W. DWIGHT, Sioux Falls
Term expires January 1, 1921

THOMAS D. POTWIN, Lemmon
Term expires January 1, 1923

AUGUST FRIEBERG, Beresford
Term expires January 1, 1925

FREDERICK A. SPAFFORD, Flandreau
Term expires January 1, 1925

J. W. CAMPBELL, Huron.
Term expires January 1, 1921

Officers of the Board.

THEODORE W. DWIGHT, President, Sioux Falls.

IRWIN D. ALDRICH, Secretary, Big Stone.

G. H. HELGERSON (State Treasurer), Treasurer Ex-Officio.

Regents Committee in Charge of the School of Mines

THOMAS D. POTWIN FREDERICK A. SPAFFORD

FACULTY OF THE SCHOOL OF MINES

CLEOPHAS CISNEY O'HARRA
President and Professor of Geology
A. B., Carthage College; Ph. D., Johns Hopkins University

HOWARD LINCOLN McLAURY
Professor of Mathematics
A. B., Oberlin College; A. M., Harvard University

JOHN McLEARIE
Professor of English
A. B., Macalester College; A. M., University of Chicago

JOSEPH JAMES RUNNER
Professor of Mineralogy and Petrography
A. B., University of Nebraska

CHARLES S. BISSON*
Professor of Chemistry
B. S., M. S., Ph. D., University of California

CHARLES LEE SWISHER
Professor of Physics
A. B., University of Illinois; A. M., University of Michigan;
Ph. D., Cornell University

WILLIAM CHARLES BOCHERT
Professor of Mining
B. S., E. M., South Dakota School of Mines

FRANK WEISS TRAPHAGEN
Professor of Metallurgy
Ph. D., Columbia University

JOHN FREDERIC MANGOLD
Professor of Civil Engineering
B. E., C. E., State University of Iowa

HUGH W. TALBOT
Associate Professor of Biology
B. S., Colgate University

*Appointed June, 1919.

AGNES L. ROBINSON
Instructor in Modern Languages and History
A. B., University of Iowa; A. M., University of Wisconsin

EDWIN CLARK
B. S., South Dakota State School of Mines
Instructor in Physics

WILLIAM A. COURSEN
Superintendent of Buildings and Grounds and Instructor in Machine Shop.

DELLA MAY HAFT
Librarian
Ph. B., University of Chicago

ANNA LEWIS
Registrar and Secretary to the President

CHARLES BENTLEY, Analyst
In Charge of Mining Experiment Station Work

Student Assistants

HUBERT MARA, Physics.
GEORGE ENOS'* Chemistry.
GARDNER GANTZ, Chemistry.
C. G. WURTZBAUGH, Chemistry.
JULIUS HALL, Metallurgy.
WILLIAM WALDSCHMIDT, Geological Museum..

Other Employes

Special instructors and assistants employed in the training of soldiers under direction of the Committee on Education and Special Training of the War Department are listed and their work described in the Pahasapa Quarterly for December, 1918.

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*Resigned near close of first semester.

STANDING COMMITTEES OF THE FACULTY

ADMISSION AND REGISTRATION

Charles L. Swisher — John McLearie
Howard L. McLaury — John F. Mangold

EMERGENCIES

Howard L. McLaury — John F. Mangold
William C. Bochert — Charles L. Swisher
John McLearie — Frank W. Traphagen

STUDENT WELFARE

William C. Bochert — John McLearie
John F. Mangold

THESES AND DEGREES

William C. Bochert — Frank W. Traphagen
Charles L. Swisher

ATHLETICS

William C. Bochert — John McLearie
Howard L. McLaury

SCHOOL MAGAZINE

John McLearie — John F. Mangold
William C. Bochert — Frank W. Traphagen

CATALOG

Howard L. McLaury — Hugh Talbot

LIBRARY

Hugh Talbot — Frank W. Traphagen
Della M. Haft

BOARD OF CONTROL OF THE STUDENT ASSOCIATION

John McLearie — Guy C. Wurtbaugh, '21
Cleophas C. O'Harra — Gardner Gantz, '20
William C. Bochert — Shafter Primrose, '22

Howard L. McLaury, Secretary of the Faculty

The regular meeting of the Faculty is held on the first Friday of each month at 3:45 p. m.

GENERAL STATEMENT

Establishment of the School

The School of Mines is a state educational institution, and is at the present almost wholly maintained by appropriations of the State Legislature. It is endowed with 40,000 acres of South Dakota land, a grant from the federal government. The income from the rental of these lands is steadily increasing. The school is under the direction of the Regents of Education. The regents, five in number, are appointed by the governor, confirmed by the senate and have control of the various public institutions of learning maintained wholly, or in part, by the state as state institutions.

The following is an extract from the act of the Legislature, establishing the School of Mines:

Section 1. (School of Mines Established.) That a School of Mines for the Territory of Dakota be established at Rapid City, in Pennington County, Dakota Territory. It shall be the object of such School of Mines to furnish facilities for the education of such persons as may desire special instruction in Chemistry, Metallurgy, Mineralogy, Geology, Mining, Milling, Engineering, Mathematics, Mechanics, Drawing, the Fundamental Laws of the United States and the Rights and Duties of Citizens.

Approved March 7, 1885.

History and Aim of the School

The State School of Mines offers young men a thorough education in mining and metallurgical engineering, believing that thereby the exploitation of the mineral resources of the state will be aided. Whenever it is possible, the school also aids the development of the mineral resources of the state by investigation of mining and metallurgical problems which arise. At the present time many graduates of the School are employed in responsible positions in the Black Hills and throughout the West

generally, and the institution is doing much toward the development of the state's mineral wealth.

The School issues from time to time, bulletins treating of Black Hills geology, and of mining and metallurgical methods. A list of the bulletins is given on a subsequent page. They may be obtained by those interested upon request.

The first building of the School was erected in 1885. It is a three-story brick structure in which were originally, chemical and assay laboratories, and class rooms. The staff of instructors was necessarily small and the course by no means complete. The school, however, under able management, gained in reputation, and, in 1887, erected a second building to serve the purpose of a metallurgical laboratory. This building, is 138 feet by 60 feet in size, and was fitted with metallurgical and mining experimental machinery. The front portion of what is now the Main Building of the school was erected in 1901 and two years later this was much enlarged by a rear addition. The central heating plant, provided in 1903, was enlarged in 1909 and important new equipment was added in 1911. The equipment of the metallurgical laboratory as now arranged was provided chiefly in the years 1905-1907.

The legislature in recent session appropriated $100,000 for a new engineering building and materially increased the funds for the general running expenses of the institution.

Location

The School of Mines is located at Rapid City the gateway to the Black Hills of South Dakota. The Black Hills region is the gem of the central northwest. Perhaps no area of equal extent in America more fittingly represents a well-selected group of community interests. By geographic position, topographic configuration, natural resources and commercial facilities it is the controlling magnet of a great area for industry, trade and recreation.

Structurally, the region is an elliptical outwardly-dipping uplift, the more distinct features of

which show a maximum extent of about 150 miles in length and 80 miles in width. The longer axis approximately coincides with the meridian except in the northern portion, where the general direction is to the northwest. Each rock unit, with its particular and sometimes striking color, yields distinctive topographic forms, the result being that in many places features of rare interest are produced. The Harney Peak area of the southern Hills, with its bold pinnacles and shoulders of coarse, bare granite, rising from their forest-clad base of metamorphosed sedimentary rocks, presents a beautiful landscape, while the steep-walled canyons of Spearfish creek, Rapid creek and Elk creek in the Northern Hills are among the most picturesque that America can show. Again to the northwest along the upper Belle Fourche valley, where the nearly horizontal sandstones and shales have been intricately carved by the various streams and where the brilliant and varied colors of the several formations harmoniously blend with a wealth of forest and pasture overlooked here and there by the stately, somber forms of porphyry buttes, there is presented a view well worth many a hardship to see.

The climatic conditions of the Black Hills proper are scarcely excelled anywhere in the United States. The rainfall is not heavy, but is generally sufficient and the chief precipitation comes during the planting and growing season when most needed. Aside from this, clear, mild days prevail through much of the year. Extreme cold and extreme heat are exceptional and of short duration.

The mining interests of the Hills are of paramount importance, but large industries, particularly forestry, agriculture, horticulture, stock raising and manufacturing share in the fundamental occupations of the people. The mineral products are gold, silver, lead, copper, iron, tin, tungsten, mica, spodumene, amblygonite, fullers earth, volcanic ash, and structural materials, including clay, gypsum, cement ingredients, and building stones. Lignite occurs in great quantity north and northeast of the Black Hills. This is now being mined in many places in small quantity and recent action of the legislature has provided opportunity to greatly de-

velop the industry. The mineral production since the first mining in 1875 is approximately $260,000,000.

In addition to the natural features of the region, the political, social, educational and moral status of the people is commendable to a marked degree. Few new countries show a greater percentage of cultured men and women interested in the healthy advancement of a whole region and in the all-round development of every individual. Communication with all parts of the Hills is facilitated by good automobile roads, and railroads are convenient to every important district. The main lines connecting with other parts of the country are the Chicago and Northwestern railway, the Chicago, Burlington and Quincy railway, and the Chicago, Milwaukee and St. Paul railway. Rapid City is on the line of the Chicago and Northwestern connecting with Omaha, also on the line of the same road connecting with the eastern part of the state, through Pierre, and on the Chicago, Milwaukee and St. Paul connecting with the eastern part of the state through Chamberlain. It has also connection with the Burlington system by means of the Rapid City, Black Hills and Western railway from Rapid City to Mystic.

Rapid City is a growing city of about 6,000 inhabitants. It was founded in 1876 and is considered by many as the most beautifully located city in the Black Hills. It is situated on Rapid Creek 3,200 feet above sea level, and a half hour's walk takes one either out on the plains or into the hills. It offers many advantages as a college and residence city. There are eight churches, a hospital, a fine opera house, four banks, a United States land office and weather bureau, wholesale and retail mercantile establishments, various manufacturing enterprises, many rooming houses, good hotels and enterprising newspapers. The city has also an excellent system of water works fed by springs four miles back in the hills; a modern illuminating gas works, a sewer system, and a hydro-electric plant furnishing light and power.

The people of Rapid City are interested in the welfare of the school and in addition to the usual

social advantages of the place, opportunity is not infrequently given the students living elsewhere to enjoy the pleasures and influences of the best homes of the city.

The distance to the chief gold mining districts of the northern Hills near Deadwood and Lead is less than fifty miles. The mining districts of the central Hills west and southwest of Rapid City are nearer. This gives the student convenient access to active mining operations whenever desired and at the same time prevents undue distraction liable to result were the school in the midst of the hurry and hustle of mines and mills.

A particularly helpful feature, the value of which cannot well be overestimated, is the opportunity the students have for working in the mines and mills of the Hills during the summer vacations. This work following the year's schooling not only surpasses the ordinary summer mining course in the gaining of practical information, but to the energetic student, is also a source of ready cash.

Electrical Engineering and Civil Engineering Courses.

The School of Mines has from the early days of its organization maintained classes in various branches of Civil Engineering and for a considerable number of years it has done the same in Electrical Engineering. The laboratory and field equipment necessary for the giving of proper instruction in these engineering studies has grown in proportion to the needs of the institution and now serves to give extended courses in these subjects. The Regents of Education have authorized the school to outline its course of study to the effect that students taking work to receive degrees already in vogue, should have the option of majoring in either Electrical or Civil Engineering. In conformity with this authorization a four year's course in Electrical Engineering and a four years' course in Civil Engineering have been outlined and these courses are now offered. In the purchase of apparatus for teaching these engineering courses efficiency has been the guiding feature and the apparatus is the best obtainable.

The varied development in the Black Hills region during the past several years has added emphasis to this work and to the urgent need for strengthening these courses. In Civil Engineering there is road making, bridge building, railroad construction, mine surveying, irrigation work and the various phases of mining and municipal problems. In Electrical Engineering there are particularly the hydro electric and the steam electric plants for the generating of light and power for mines and metallurgical plants, manufactories and municipalities. Five hydro electric plants on as many different mountain streams of the Black Hills and costing more than two and a half million dollars serve to indicate the present trend of activity and to indicate the latent possibilities of our swifter streams. Several thermo electric plants are also in operation.

Buildings and Grounds.

The buildings in which the work of the School is carried on are four in number: First the original School of Mines building, a commodious brick structure, three stories in height, situated in the west part of the grounds, and at present time devoted to modern languages, biology and shop work. It contains class rooms for the study of languages, mathematics, and history, a laboratory for biology, and a small woodshop. It is heated throughout by steam from the central power plant and is lighted by electricity.

The Main Building, a large, brick structure, with native sandstone trimmings, three stories in height, built in two wings. This building contains, in the front wing on the first floor, a large entrance hall, the President's and Registrar's offices, lecture rooms for Mathematics and English, and the Geological Museum; also, in the rear, the Library and the Department of Geology and Mineralogy, consisting of lecture room, office, map and mineralogical store rooms, and a thoroughly equipped mineralogical laboratory. On the second floor are the Department of Chemistry and the Department of Civil Engineering. The chemical laboratories comprise the general, qualitative and quantitative laboratories, with balance room, supply rooms, lecture

room and office, together with a private laboratory for the professor in charge. The rooms for the Department of Civil Engineering consist of instructor's office, two large drawing rooms, a lecture room, supply rooms and a room equipped for making blue prints. In the basement are the physical laboratories, an experimental room, lecture rooms, store rooms, a locker room, and lavatories.

The Metallurgical building is 138 feet by 60 feet in plan, two stories high, built of brick covered with cement. This building is devoted exclusively to the Departments of Mining and Metallurgy, and to the work of the State Mining Experiment Station. It contains, on the first floor, a large laboratory for advanced metallurgical chemistry, a well equipped balance room, containing massive concrete piers for the mounting of balances, chemical laboratory and supply room, assay laboratory and a large assay furnace room. In the rear of the assay furnace room is the metallurgical machinery and apparatus and storage bins for ore and fuel. On the second floor are the lecture rooms of the Departments of Mining and Metallurgy, offices of these departments, and the mining and metallurgical museum.

The heating plant supplies heat for the buildings mentioned above, and power for the metallurgical and other laboratories by means of two 35 K. W. steam turbines connected to direct current generators. A third turbine unit similar to the above, but of seven K. W. is available for experimental work, and a three-panel switch board supplies connections.

The engineering building, appropriation for which has been provided will add greatly to the facilities of the institution and will serve to house needed apparatus not hitherto obtainable.

EQUIPMENT

The institution when providing itself with apparatus endeavors to secure the most serviceable manufactured and care is taken to see that every piece is kept in as good condition as possible. Effort is made to see that every student has proper facili-

ties in all of the laboratories and he is taught to realize that the grade of materials used deserve the high quality of work expected.

Library.

The library occupies a well lighted room on the first floor of the Main Building. It is made up of more than six thousand volumes and includes encyclopedias, standard works on Metallurgy, Mining, Geology, Chemistry, Engineering, Physics, Biology, Mathematics, English, History, Sociology, Economics and many works of a general nature.

Many authoritative, scientific and technical journals published by the leading societies and organizations of the United States and foreign countries are found on the reading tables and the library has complete, well bound, files of most of these. Monthly periodical indexes make the material of these journals available for ready reference.

The library is a repository of the documents of the United States Geological Survey, many of the state geological surveys and surveys of some of the foreign countries.

The Dewey system of classification is used and a card index gives author, title and subject.

All students have direct access to the shelves and are thus able to make the best possible use of the library. Books commonly consulted for reference may not be removed from the room but others by special arrangement may be withdrawn for a period of two weeks. The privileges of the library are extended to those not attending the institution. Arrangement for these should be made through the librarian.

The following named complete sets will serve to indicate the well selected nature of the scientific and technical literature available:

	Vols.
Transactions American Institute of Mining Engineers	60
Transactions British Institute of Mining Engineers	54
Engineering and Mining Journal	106
Mineral Industry	26

Coal Age 14
Concrete and Cement Age 12
Journal Iron and Steel Institute 97
Journal Institute of Metals 20
Engineering News 80
Engineering Magazine 51
Engineering Index 16
Transactions American Inst. of Electrical Engineers 33
Transactions Inst. of Mining and Metallurgy .. 23
Journal American Chemical Society 40
Chemical Abstracts 11
Transactions American Electro Chemical Society 32
Journal Society of Chemical Industry 37
Zeitschrift fur Anorganische Chemie 57
Electro Chemical and Metallurgical Industry .. 9
Journal Industrial and Engineering Society ... 9
Journal Chemical, Metallurgical and Mining Society of South Africa 17
Bulletin Geological Society of America 29
Journal of Geology 26
Journal of Economic Geology 13
International Geological Congress—Special Reports on Coal and Iron 57
Physical Review 41
American Journal of Science 200
Proceedings Royal Society of London 90
U. S. Bureau of Standards 13
National Geographic Magazine 32
U. S. Geol. Survey Publications (Including Monographs, Professional Papers, Bulletins, Water Supply Papers, Mineral Resources, etc.) 400

There are also sets for general reference such as:

Pooles Index of Periodicals, 1802-1906.
Readers Guide to Periodical Literature, 1900 to date
U. S. Catalog of Books in Print 1912 to date.
Congressional Document Catalog 12
National Cyclopedia of American Biography ... 16
Cyclopedia of Education 5

Also some of the well known historical and literary monthlies, for example:

Atlantic Monthly 121
American Review of Reviews 53

Century Magazine 96

In addition to the above there are many sets and partial sets of periodicals, atlasses and maps for which there is no room here for listing. These and the many standard single volumes have been selected with care and few libraries of its size can show a better series of up to date useful volumes.

Drawing Rooms.

In the Department of Engineering are two large drawing rooms—one for Freshman work, the other for Sophomore and Junior work.

The rooms are well lighted and fitted with especially designed drawing desks, each desk containing lockers in which students take care of their supplies. Between the two drawing rooms there is a small room for the making of blue prints. It contains the blue print machine, sliding on a frame in the window, with south exposure so that sunlight is available for the greater part of the day. Sinks for washing blue, brown and black prints are provided.

Chemical Laboratories.

There are four chemical laboratories in the Main Building—one for general chemistry, one for qualitative analysis, one for quantitative analysis, and a special laboratory for fuel and water analysis. The quantitative and qualitative laboratories are equipped with large individual desks with tile tops, each desk being supplied with gas from the city mains. Between the desks are sinks with flowing water. The laboratories are also supplied with compressed air and with apparatus for suction. Each student receives a separate and complete set of reagent bottles and supplies. The laboratories are well lighted and provided with ample hoods to carry off fumes. The quantitative laboratory is equipped with a separate weighing room in which are analytical balances of standard makes. In addition to these laboratories there is a private laboratory for the professor of chemistry, a special dark room for spectroscopy, a dark room to be fitted for photochemistry, and two supply rooms from which the students get their apparatus and chemicals as needed.

The apparatus is ample for all mineral, alloy and rock analysis, as well as for research along certain lines. The special apparatus includes combustion furnaces, apparatus for gas analysis, facilities for electro-chemistry, calorimeters for fuel analysis, spectroscopes for qualitative experiments, and electroscopes for determination of radium and uranium in waters, gases, and minerals.

Biological Laboratory.

This laboratory is equipped with high class apparatus and materials. Compound and simple microscopes are provided the student for the study of forms, structures, interrelation of parts and functions and camera lucidas and a projectionscope allow for the execution of careful drawings. Several hundred thin sections of animal and plant forms are available for study and three kinds of microtomes are for use in making sections. There are also excellent anatomical models of one or more forms of the principal groups of animals, a number of imported charts showing growth habits, skeletons, including that of the human, bacterial apparatus, and a large aquarium with living forms for the study of habits, interdependence of organisms and the relation of organisms to their surroundings.

Physical Laboratory.

The Physical Laboratory is located in the basement of the Main Building. It has a cement floor and the tables are on cement pillars, thus securing stable foundations for such apparatus and instruments as require them. The laboratory is well equipped for accurate experimental work. Among the more important pieces of apparatus are precision balances, air pumps, acceleration apparatus and Atwood machine; a variety of apparatus for specific gravity, including hydrometers, Jolly balances, Westphal balances, etc., large Steinheil spectroscope, large vernier spectrometer, precision apparatus for complete measurements in interference, diffraction, polarization and dispersion of light; apparatus for sound measurements; complete equipment for determinations of specific heat, heat of combustion, heat of vaporization, etc., complete apparatus

for the determination of the mechanical equivalent of heat, seconds clock with electrical attachment; barometers, precision thermometers and pyrometers, air thermometer, Beckman thermometers; and a complete line of instruments for electrical measurements, including Weston voltmeters, ammeters and wattmeters for a variety of ranges, Weston and Paul alternating current voltmeters and ammeters, Leeds and Northrup potentiometer, Leeds and Northrup precision wheatstone bridge, Kohlrausch bridge, standard condensers, Siemens electrodynamometers, Braun hot wire meters, Nalder Bros. standard inductance, Weston, Leeds & Northrup, and Cambridge Scientific Instrument Co.'s galvanometers, Braun electrometers, Dolezalek quadrant electrometer, aluminum and gold leaf electrometers and electroscopes, magnetometers, voltmeters, standard resistances; also completely equipped switch boards for both high and low voltage distribution of direct or one, two or three phase alternating current, and many special pieces of electrical apparatus, as Tesla transformers, induction coils, X-ray apparatus, spark and arc spectrum apparatus; a variety of dynamos, motors, motor-generator set, induction machines, gasoline engines and models of steam and gas engines.

The School also possesses a completely equipped wireless telegraph station consisting of a sending set of one KW capacity and sensitive receiving sets for long distance messages. Among the larger pieces of apparatus is a Westinghouse 10 K. W. rotary converter designed for many different kinds of experimental work and embodying in itself the features of a number of different electrical dynamo machines. It is designed to be operated upon either alternating or direct current and will act as a generator or as a motor. When using alternating current its operation may be one, two, or three phase. Complete switchboard equipment is provided for its control in any one of its many modes of operation and includes a complete set of high grade measuring instruments for both alternating and direct current measurements. These include ammeters, voltmeters, wattmeters, power factor meters, frequency meters and dial synchroscope, all mounted on white

marble panels which also carry the A. C. and D. C. circuit breakers, switches, plugs, etc. These switchboards also control a General Electric Company's 15 H. P. three phase induction motor with phase wound motor and drum control for variable speed service. This machine may be connected to the rotary converter above described by a link belt silent chain for full load tests on either machine. The equipment also includes a one K. W. motor generator set consisting of a single phase induction motor and a shunt wound generator. There are also a number of smaller A. C. and D. C. motors of various types. In addition to the above, the school heating and lighting plant and the equipment of the Departments of Mining and Metallurgy afford the student opportunity for making tests on dynamos and motors, engines and turbines of commercial sizes. The laboratory is well equipped with tools and work benches for the construction of special pieces of apparatus.

Apparatus for Civil Engineering

The School of Mines is well equipped with surveying instruments for all kinds of plane surveying. It possesses one Gurley Y level, one Dietzgen Y level, one Berger Dumpy level, one Bausch and Lomb precision level, two Gurly transits, one with solar attachment, one Keuffel and Esser transit with Saegmuller solar attachment, one Dietzgen transit with auxiliary mining telescope, one Ainsworth transit with auxiliary mining telescope, one Bausch and Lomb mining transit, one Keuffel and Esser plane table, one Keuffel and Esser sextant, one clinometer, one planimeter, together with complete equipments of stadia rods, leveling rods, range poles, field glasses, tapes, chains, axes, etc. The topography of the lands near the school offers excellent opportunity for all kinds of field work, with every degree of difficulty from flat prairie to the most rugged of rough hill country.

A Riehle cement testing machine is available for testing cement briquettes.

Assay Laboratory.

The assay laboratory contains a room in which the students are provided with individual desks,

pulp balances for the mixing of assay charges; a balance room provided with concrete foundation piers; the pulp room in which the ore samples, etc., are crushed and sampled, and the furnace room in which furnace work is done exclusively. This furnace room contains two gasoline assay furnaces and five double muffle-furnaces, heated by soft coal. These are placed in openings in a heavy dividing wall, separating the machinery hall from the front part of the building. In this way the front of the furnaces with the muffle openings are in the furnace room, flush with the wall, while the firing and taking out of the ashes is done on the other side of the wall, thus avoiding the dust and dirt in the main work room. The furnace room is fireproof. There is a melting furnace using coke, and gasoline furnaces, made by Braun & Company, San Francisco. Large gas furnaces are available for experimental work, such as roasting, smelting, annealing, etc.

The balance room is provided with Ainsworth, Eimer & Amend, Thompson, and Keller balances. In the pulp room an electric motor furnishes power for the small Gates sample crusher and a sample grinder. A Calkins automatic cupel machine is used for making cupels. A large number of ore samples are kept on hand. Ores from all parts of this country are provided in great variety. The nearness of smelters and mills makes it comparatively easy to procure many types of furnace products, such as mattes, flue dust, fume, and umpire sample for close checking work.

Mining and Metallurgical Laboratories.

There are two metallurgical laboratories in the Metallurgical Building; one in which are conducted metallurgical experiments as outlined in Metallurgy 11 and 13, and the other in which the various metallurgical processes are performed on a commercial scale.

The experimental laboratory is equipped with individual desks provided with gas and air; analytical and pulp balances, hot plates, and water sinks; a complete cyanide plant of ten pounds capacity, consisting of a Trojan ball mill, high pressure blow-

er, a Pachuca agitator and filter press; a Braun cyanide plant, a Hendryx mechanical agitator; gas and electric furnaces, pyrometers, potentiometers and platinum resistance, pyrometer, Parr and Mahler-bomb calorimeters, electrical measuring instruments, etc.

The commercial laboratory is designed to illustrate chiefly the metallurgy of gold, silver, copper and lead. It is best adapted to handle ore in quantities of from three to five tons, but larger quantities may be treated if necessary.

The crushing machinery consists of a No. O Gates breaker, a pair of 16x10 inch rigid rolls, a 6x4 inch Bosworth jaw crusher, a 10x4 ft. Alsing tube mill, a 3½ ft. Huntington mill and a 3-300 lb. stamp battery and amalgamating plates.

The cyanide plant consists of two 5x3 ft. sand tanks, two 5x5 ft. slime tanks, two 4x3½ ft. solution storage tanks; two 4x3½ ft. gold solution tanks and two zinc boxes. For the agitation of slime a 10x2½ ft. Pachuca tank is used, while for slime thickening and filtration a 5 ft. Callow cone and small Moore vacuum filter are employed. The accessory apparatus for cyanidation consists of four 1½ inch centrifugal pumps, a vacuum pump, an air compressor and receiver, and three electric motors for power, etc. The above plant is extremely flexible, so than any variation from an all-sand to an all-slime process can be demonstrated on a commercial scale.

The ore dressing apparatus consists of a Traylor table, a Frue Vanner, two classifying cones, an impact screen, a Vezin sampler, and a Jarvis experimental jig.

The present oil flotation apparatus consists of a complete Callow laboratory machine, a modified Hoover machine, and a slide machine. Important additions are contemplated for the coming year.

The smelting machinery consists of a 30-inch blast furnace which may be used for either lead or copper smelting, forehearths, slag cars, and other accessories; a small Bruckner roasting furnace, and a Green rotary blower. The crushing and cyaniding and concentrating machinery is so placed that

any combination of apparatus desirable may be secured and practically every possible system of treatment worked out.

Metallographic Laboratory

This laboratory is equipped with four metallographic microscopes, microphotographic apparatus, polishing machines, etc., and much pyrometer apparatus, of various kinds,including potentiometer, resistance boxes, etc. Electric furnaces are provided for heat experiments and for metallography.

Mineralogical Laboratory.

This is a large room well equipped with low tables arranged for study and determination of minerals. Students are provided with the necessary reagents and apparatus, by the department. Each student has his own locker. A large working collection of carefully labeled minerals available for students' use is kept in specially designed cases ready of access, and a considerable collection of unknown minerals is at hand for determination.

Geological Museum.

This museum is an important feature in the equipment of the School of Mines. Its contents have been chosen to assist in the teaching of geology, mineralogy, petrography, and paleontology, rather than to become a storehouse of curiosities. The room has a floor area of thirty-six by forty-seven feet, is twelve feet high, and is lighted by ten large windows.

Two kinds of cases are used for the display of specimens—central cases and wall cases. There are eight central cases of oak, each consisting of two parts of three compartments each, with glazed tops, and a six compartment massive base; the whole constructed in such a manner as to serve practically as two sections, fitting tightly back to back. The display surface, under glass, is nearly fifty square feet for each case. The bases are especially designed for the storage of material not needed for constant exhibition.

The wall cases have glazed doors. Each is seven feet six inches high and contains three double door compartments of six shelves. The cases are particularly adapted for the display of large specimens.

Cases one and two and four contain a general collection of minerals arranged according to Dana's system of classification. Case three contains a series of specimens to illustrate general features of mineralogy, geology and petrography. Case seven contains a collection of well preserved fossils, carefully selected to show the more prominent features of paleontological interest. Cases five and six contain representative collections of Black Hills ores and rocks. Case eight contains Cretaceous and Tertiary fossils from the Black Hills region, mainly from the Cheyenne river and the White river Badlands.

The wall cases are for large specimens of all classes, some of which are very beautiful. The collection from the Black Hills is especially noteworthy.

The museum contains two large relief maps of the Black Hills made for the St. Louis exposition, also a very valuable and unique ore section of the Homestake mine, donated by the Homestake Mining Company, of Lead, South Dakota. Many framed maps of mines and important geological regions adorn the walls and serve as an added educational feature of the room.

The collection of minerals exhibited by the school at the St. Louis Exposition, 1904, received a diploma and gold medal, as did also the Black Hills relief maps.

Mining and Metallurgical Museum.

This is situated on the second floor of the Metallurgical Building, in a large, well lighted room and contains wall cases for the display of specimens. It has a fair collection of furnace products, such as slags, mattes, alloys, fuels, refractory materials, and wall boards and hoisting ropes and screens, safety lamps and models of head frames and similar materials. In time it will become a valuable adjunct to the teaching of mining and metallurgical

subjects. It is added to from time to tmie by the kindness of manufacturers and mining companies, who donate exhibits. Occasional purchases are also made.

Publications.

The school publishes at irregular intervals bulletins of greater or less length on subjects covered by its various lines of activity. These may be obtained free of cost by persons interested so long as there are copies in stock. Twelve have been published. They are as follows:

Bulletin No. 1—Preliminary Report of the Dakota School of Mines upon the Geology, Mineral Resources and Mills of the Black Hills of Dakota; 171 pages. 1888. By F. R. Carpenter and H. O. Hofman. **(Out of Print.)**

Bulletin No. 2—Notes on the Geology and Mineral Deposits of a Portion of the Southern Black Hills; 41 pages, 1899. By C. C. O'Harra and A. Forsyth.

Bulletin No. 3—Cyanide Experiments on the Siliceous Ores of the Northern Black Hills, etc.; 27 pages. 1900. By A. Forsyth and G. H. Clevenger.

Bulletin No. 4—Two papers: A History of the Early Explorations, and of the Progress of Geological Investigation in the Black Hills Region; and A. Bibliography of Contributions to the Geology and Geography of the Black Hills Region; 88 pages. 1900. By C. C. O'Harra. **(Out of Print.)**

Bulletin No. 5—The Cyanide Process in the Black Hills of South Dakota; 88 pages. 1902. By C. H. Fulton. **(Out of Print.)**

Bulletin No. 6—The Mineral Wealth of the Black Hills; 88 pages. 1902. By C. C. O'Harra. **(Out of Print.)**

Bulletin No. 7—Metallurgical Practice in the Black Hills of South Dakota; 63 pages. 1904. By C. H. Fulton.

Bulletin No. 8—The Cement Resources of the Black Hills; 55 pages. 1908. By C. C. O'Harra, M. F. Coolbaugh, M. A. Ehle Jr., and C. H. Fulton.

Bulletin No. 9—The Badland Formations of the Black Hills Region; 152 pages. 1910. By C. C. O'Harra. **(Out of Print.)**

Bulletin No. 10—The Minerals of the Black Hills; 200 pages. 1914. By Victor Zeigler.

Bulletin No. 11—A Bibliography of the Geology and Mining Interests of the Black Hills Region; 225 pages. 1917. By C. C. O'Harra.

Bulletin No. 12—The Occurrence, Chemistry, Metallurgy and Uses of Tungsten with Special Reference to the Black Hills of South Dakota. By J. J. Runner and M. L. Hartmann, including a Bibliography of Tungsten by M. L. Hartmann. 264 pages. 1918.

THE PAHASAPA QUARTERLY

This magazine, the first number of which was issued in December, 1911, is published by the faculty and students of the institution. As the name indicates, it appears four times during the school year and is devoted to the interests of the School of Mines and the Black Hills region. It contains articles of interest to engineers generally and to the students and alumni of the School of Mines especially.

The magazine has contained many papers of timely importance and several times a special number has dealt almost entirely with one particular subject, for example, the Tungsten number, the Northern Black Hills number, the Manganese number, the Lignite number, the Good Roads number, and the Students Army Training Corps number. The following individual papers serve to illustrate the general nature of the articles presented.

Climatic Characteristics of the Black Hills.

Lithium, Its Occurrence, Uses, Determination and Methods of Extraction.

Water Power Possibilities of the Black Hills.

Tin, Occurrence in the Black Hills and Methods of Analysis.

Radium and Its Geological Significance.

Limitations of the Fire Assay.

Notes on Molybdate and Sulphate Methods for Determination of Lead.

Mill Construction and Costs.

Flotation of Minerals.

An Investigation of the Irrigation Possibilities of Little Elk Creek.

An Investigation of the Extraction of Potash from Feldspar.

Cambrian Blue Siliceous Ores of the Black Hills

The Angostura Irrigation Project.

The Belle Fourche Dam and Irrigation Project.

The Homestake Mine.

The Golden Reward Roaster.

The Viscosity of Blast Furnace Slags at High Temperature.

Flotation of Gold Ore.

Metallurgy and the War.

The Geology of Petroleum Deposits.

Oil Well Drilling.

The Refining of Petroleum.

The Engineer in War.

The Engineer After the War.

Lignite Coals and Their Utilization.

Sampling and Analyzing Coal.

The Origin of Peat.

The Origin of Coal.

Roads: Past, Present, Future.

STUDENTS' EXPENSES

Tuition.

The tuition and incidental fee is $6 per semester, or $12 per year, payable in advance on registration. This fee is the same to residents and nonresidents of the state.

According to Section 209 of the Political Code, 1903, page 40:

"The regents shall fix all rates of tuition and other fees, to be paid by students, but such rates shall be the same in all the different institutions. They may receive, in any one of the institutions under their control, free of tuition, two students, appointed by each State Senator and one by each Representative of the State Legislature, which appointees shall be residents of their respective districts or counties, and whose term shall expire with the term of office of said senator or representative, provided that such appointees shall comply with all the rules and requirements of the institution which

they desire to enter. No student, however, shall receive any other gratuity whatever."

The 1919 session of the Legislature modified the tuition requirements for residents of South Dakota, who have seen military service. Part of this enactments is as follows:

Section 1: That Section 5577 of the South Dakota Revised Code of 1919 is hereby amended to read as follows:

Section 5577: (Tuition Free—Veterans): Any person residing in this state, who has served in the army or navy of the United States during any war in which the United States has been engaged, including members of the South Dakota National Guard, who performed military service outside of the borders of this state, and has been honorably discharged from such service, has been furloughed into any reserve branch of the military or naval service of the United States, or who performed active war service, such as nursing or assisting in the care of soldiers and sailors in any government hospital, field or camp, as a member of the Red Cross or any other similar organization engaged in war relief work, which shall have been recognized and approved by the government of the United States, during any of the periods herein before mentioned, shall upon complying with all the other requirements for admission be entitled to attend and pursue any course or courses in any state educational institution, under the control and management of the Board of Regents of this State, without the payment of charges for tuition. It shall be the duty of the Board of Regents to determine who are entitled to the benefits of this act. The term "honorably discharged" shall be construed to include the terms, "good discharge" and "release from active service."

Laboratory Fees and Deposits

The fees named below cover only the cost of materials and supplies necessarily consumed in the laboratory courses mentioned. All fees and deposits must be paid on registration at the beginning of each semester.

Chemistry 3, General Chemistry .....$ 5.00
Chemistry 6, Qualitative Analysis 5.00

Chemistry 7, Qualitative Analysis 5.00
Chemistry 8, Quantitative Analysis 6.00
Chemistry 9, Metallurgical Analysis 6.00
Metallurgy 11-13, Metallurgical Laboratory.. 5.00
Metallurgy 15, Cyanide Testing 5.00
Metallurgy 2, Assaying 5.00
Students' Activities Fee, required of all regularly enrolled students, per semester 3.00
Fee for bachelor's degree 5.00
Fee for advanced degree 10.00
Fee for permit for "conditioned" examination 2.00

The deposits named below are made to cover the cost of breakage and extra supplies used in the courses named. The unused portion of each deposit will be returned to the student at the end of each semester.

Civil Engineering, deposit .....$ 5.00
Metallurgy 15, Cyanide Testing, deposit 10.00
Metallurgy 2, Assaying, deposit 20.00
General breakage deposit for engineering students taking laboratory courses in Chemistry or Metallurgy 5.00

No platinum is furnished by the Department of Chemistry.

Other Expenses of the Nature of Fees

The Department of Engineering furnishes supplies for the mechanical drawing courses, practically at cost.

Engineering 1-2, Mechanical Drawing, will cost approximately $5.00 for the year, exclusive of drawing instruments, which the student purchases on his own account, prices ranging from $12.00 up for a good set of instruments.

Engineering 3-4, Descriptive Geometry, will cost approximately $2.00 for the year.

Engineering 7, Topographic Drawing and Engineering 9, Machine Design, will cost $2.00 for the year.

Living Expenses.

Students will find living expenses in Rapid City approximately the same as in other parts of the country. In order to lessen these expenses as much as possible, the School of Mines maintains a dining

hall in which meals are served at cost. During the past year the charge to students was $5.00 per week. For single meals the charge was thirty cents. Effort will be made to keep the charges for the coming year as near the earlier figures as market conditions will allow. Rooms may be obtained in the city with private families or in boarding houses or hotels.

Incidental Expenses.

Students are required, at various times, to take part in the geological, mining and metallurgical trips undertaken into the Black Hills mining district. The geological trip of the Freshman year usually costs the student about $10. The surveying trips in the Sophomore year will cost about $12. Trips in the Junior and Senior year, for mining and metallurgical exploration, cost a similar sum; so that the student should figure on a cost of from $30 to $40 at least, for expenses of this kind during his four years' course at the school.

Opportunities for Self Help

Opportunity for self help in a city the size of Rapid City is necessarily limited. The growth of the place however is such as to keep up a considerable demand for help of many kinds and most any worthy, industrious student can find employment. It is to be borne in mind that the course of study is an arduous one and requires the student's best effort, and if conscientiously and satisfactorily performed, will leave comparatively little outside time in which to earn money.

Some students find employment which nets them their board and lodging by doing chores in private families or assisting in some of the stores, shops, mills, or manufacturing plants. Some find employment in the boarding houses. The school is able to assist a few students, to some extent, by employing them in the capacity of assistant janitors and similar work.

Students who have become acquainted, by a residence in town for a year or two, find it easier to obtain work than strangers. For this reason it is

essential that a student who comes as a stranger to enter the school should be provided with sufficient funds to carry him through the first year, at the very least.

SCHOOL ACTIVITIES

Students' Association.—The students have always maintained one or more organizations for the direction of student activities. Recently, in order to better correlate all of these activities, the Students' Association was formed. As stated in the Constitution, the object of the Association, is to provide a representative body of students which, by virtue of the position of influence of its members, in student affairs, shall be able to supervise and control all non-academic activities of the student body as a whole; second, to bring about a closer union of student organizations and to establish a more effective control of non-academic student affairs; third, to provide a suitable medium through which student opinion may be presented to college authority and the opinion of the college authority may be presented to the students.

Athletics.—The institution heartily encourages athletics within the proper limits. Beginning with the year 1919, an all school year athletic director will be provided.

Orchestra and Glee Club.—The Orchestra and the Glee Club, each of which is under the direction of a trained musician, were organized to accommodate such students as are musically inclined. There is no special charge to the student for instruction, his activity fee covering all costs.

Students' Activities Fee.—A fee of $6.00 per year is expected of all students in order that activities not otherwise provided for, may be properly financed. The payment of this fee, gives the student access to athletic grounds, payment for admission to games, provides him with athletic and other like material when needed, and subscription to the school magazine the Pahasapa Quarterly.

MINING EXPERIMENT STATION.

The School of Mines aims to assist the prospector and mining man in every reasonable way in de-

termining the nature and value of such rocks, minerals, and ores as he may have and in solving the technical problems in connection with their utilization. For many years members of the institution have given a considerable part of their services to the determination of minerals and rocks and to the assaying and analyzing of samples sent in for determination. A large amount of experimental work has been done in order to learn the most economic methods of extracting values from ores. More re-recently the state has appropriated money to carry on the investigations in systematic manner and an experienced analyst is in charge of the work. Every effort is put forth to make the service available at low cost to all people of South Dakota who may be interested. Assays for gold and silver are made for twenty-five cents per sample. Many qualitative analyses are made free and quantitative analyses are made at as low rates as possible. Prices will be sent upon application. All samples for analysis or assay and letters accompanying the same may be addressed to the Mining Experiment Station, State School of Mines, Rapid City, South Dakota.

REQUIREMENTS FOR ADMISSION.

Freshman Class

Requirements for admission to the Freshman class are as follows:

Fifteen units are necessary for entrance.

Required Units.

Algebra	1.5	units
Plane Geometery	1	unit
Solid Geometry	0.5	unit
English	3	units
History	1	unit
Physics	1	unit
Chemistry	1	unit
Total required units	9	units

Elective Units.

French	1, 2 or 3	units
German	1, 2 or 3	units
Latin	2, 3 or 4	units

Greek	1	unit
Spanish	1 or 2	units
English	1 or 2	units
History	1 or 2	units
Algebra	0.5	unit
Science	1 or 2	units
Drawing	1	unit
Shop Work	1	unit
Civil Government	0.5	unit
Bookkeeping	1	unit
Elective units required for entrance	6	units

A unit course of study is defined as a course covering a school year of 36 weeks with 5 periods of at least 45 minutes each per week.

Methods of Entering the School.

Graduates of accredited High Schools in the state of South Dakota and other states will be provisionally admitted without examination, if they present proper credentials, certifying to the fact that they have completed the studies mentioned under the requirements for admission.

Other candidates for admission will be given credit for so many of the fifteen necessary units as they may bring credits for, and will be permitted to make up the remainder in the Preparatory Science Department of the School of Mines, which is maintained for the special purpose of preparing students found deficient in entrance requirements.

Application blanks for entrance will be sent upon request.

DESCRIPTION OF UNITS REQUIRED FOR ENTRANCE

Required Units.

Mathematics: The three units which may be offered in mathematics are as follows:

Algebra—One and one-half units. The equivalent of A, B and C in Algebra described under Preparatory Mathematics in the Preparatory Announcement.

Plane Geometry—One unit. The equivalent of plane geometry described under Preparatory Mathematics.

Solid Geometry—One-half unit. The equivalent of solid geometry described under Preparatory Mathematics.

English—Three units. The equivalent of English 1-2 and 3-4 described under Preparatory English and other courses described in that department.

Physics—One unit. The equivalent of physics described under Preparatory Physics in the Preparatory Science Announcement.

Chemistry—One unit. The equivalent of elementary chemistry described in the Preparatory Science Announcement.

History—One unit. The History of the United States, English, Ancient or Modern History as described under History in the Preparatory Science Announcement.

Elective Units.

The equivalent of courses, not mentioned above, described under Languages, History, English and Preparatory Science, in the Preparatory Science Announcement.

Special Students.

Applicants for admission, who are graduates of colleges or technical schools will be admitted as special students and permitted to take any subject they desire, taught in connection with the regular courses. Persons of mature age, who have been employed in mines and metallurgical plants and who desire to take up special courses particularly along the lines of mining, metallurgy and geology, will be admitted as special students, provided they show that they have sufficient foundation to take up the work with profit to themselves. No immature person will be permitted to enter the school to take advanced courses, such as Assaying, Metallurgy, etc.

GENERAL STUDIES.

The South Dakota School of Mines is frequently approached by students, both men and women, who have no ambition to become engineers but who seek to enlarge their mental horizon by taking some of the subjects of more general interest offered in the engineering and preparatory courses. To all

such persons the School of Mines extends a cordial welcome and offers every facility at its disposal for their cultural benefit. The attention of persons so minded is called to the following list of subjects, all taken from the regular courses, which have a general educational value: English literature, foreign language—including French, German and Spanish—history, sociology, economics, mathematics, biology, geology, mineralogy, chemistry, physics, astronomy, drawing. From these subjects a course may easily be selected corresponding to the first two years of a general college curriculum. Every effort will be made to give satisfactory attention to special students taking work along any of these lines. The only fees charged are the usual tuition and students' activities fees and such laboratory fees as may be required in courses taken.

Summer School.

The summer school in surveying begins immediately after commencement and is arranged especially to accommodate students who are completing the sophomore year. The electrical engineers spend two weeks in plane surveying, the mining and metallurgical engineering students spend two weeks in plane surveying and one week in underground mining surveying, and the students in civil engineering spend six weeks in surveying as outlined in the civil engineering course. Every effort is exerted to make this work practical and instructive. The mining surveying is done in a suitable mine in the Black Hills, the remainder of the work is done in the vicinity of Rapid City.

Preparatory Department.

The School of Mines finds it necessary to maintain a Preparatory Science course in order to meet the requirements of students entering without having had adequate high school facilities. Heretofore this course has covered four full years. Beginning with the school year 1919-20 only the second, third and fourth years will be given. It is expected later to give only the third and fourth years. These correspond pretty closely to the last two years of the best high schools but more em-

phasis is placed on subjects leading to scientific and technical careers.

The School of Mines faculty has direct supervision of the work. Two instructors devote their entire time to the department and several of the professors teach one or more subjects. The same laboratory facilities are afforded preparatory students as are enjoyed by the higher classes.

The tuition and incidental fee is $12 per year or $6 per semester.

A special announcement describing the Preparatory Science Course is published and will be sent on application.

Admission to Advanced Standing.

Graduates of college and technical schools who enter the school as candidates for a degree will receive proper credit for all such studies which they have completed and which form part of the curriculum of the School of Mines. The faculty decide these cases upon the basis of individual merit.

Degrees.

The School of Mines offers degrees as follows: That of Bachelor of Science in Mining Engineering, to the candidate who has successfully completed the regular Mining Engineering Course, and that of Bachelor of Science in Metallurgical Engineering, to the candidate who has completed successfully the Metallurgical Engineering Course.

The degree of Engineer of Mines, or of Metallurgical Engineer, will be conferred upon graduates of the corresponding engineering course of the school, who shall have devoted one year at graduate study in the School of Mines, under the direction of the faculty, passing required examinations upon the studies pursued, or to those who shall furnish evidence of two years successful experience in mining and metallurgical work, and who shall submit an adequate thesis which shall be duly considered and accepted by the faculty before such advanced degree will be granted.

Candidates for the engineer's degree should make application for such not later than December

first of the school year in which graduate work is begun.

In order to allow time for correspondence and corrections, the thesis of a non-resident candidate should be submitted not later than April 15th of the year in which the degree is to be granted.

If the completed thesis is approved by the head of the department concerned, he shall transmit it to the committee on advanced degree with his approval in writing.

A true and perfect copy of the corrected and approved thesis must be filed with the librarian not later than the 20th of May.

Thesis.

Every candidate for a degree in either engineering course is required to present a thesis on some subject patent to his course before he will receive his degree.

At the beginning of the school year the individual members of the senior class are expected to consult with the thesis committee of the faculty regarding the subjects of their thesis. Preference will be given to subjects selected by the student, provided they meet the approval of the committee. Students unable to select subjects for themselves will be assigned subjects by the committee.

Report of progress in thesis work must be made at stated intervals to the thesis committee. Thesis must be submitted to the faculty not later than May 15th, and must be typewritten on paper 8½x11 inches in size. Two copies must be furnished: one for the department within which the thesis falls, and one for the library. No degree will be granted unless the conditions concerning thesis are fully satisfied.

The following is a list of some of the theses that have been submitted:

Arentz, S. S. Some Experiments on Bromo-Cyanogen.

Hall, Arthur E. Some Features Illustrating the Quantitative Chemistry of the National Smelter Blast Furnaces.

West, Elmer W. Notes on Assay Slags.

Anderson, O. A. The Grand View Mining Property with Plan and Estimated Cost of Development Work and Reduction Plant.

Coolidge, E. B., and Gaines, Wm. N. The Metallurgical Treatment of Ore from the Queen Bee Property.

Curran, H. T. and O'Brien, B. D. Experiments on the Blue Ores of the Black Hills.

Read, John B. The Distribution of Gold and Silver in the Siliceous Ores of the Black Hills.

Seiter, Herbert, and Penhoel, L. C. Some Suggestions Relative to the Development of the Grand View Mining Property Near Silver City.

Smith, E. V. L. Development of a Low Grade Mining Property, Kittilas County, Washington.

Wetherald, Fred H. The Determination of Formation Temperatures of Certain Silicates.

Whytock, Peter R. Preliminary Notes on Some Supposed Nickeliferous Minerals of the Black Hills.

Bryant, Frank. An Investigation of the Different Cyanide Methods, as Applied to the Treatment of the Black Hills "Blue" Ores.

Ellerman, Otto. The Gordelia Mining Company of Rochford, South Dakota.

Matson, B. V., and Anderson, F. B. Report on the Hematite and Delaware Mines, Including Metallurgical Treatment.

Morris, Milton, and Cornell, W. L. Experiments on Slag Losses Due to Borax Glass.

Van Nuys, C. C. Plane Curves.

Wells, L. P., and Whitmore, C. F. Report on Coolgarde Group of Claims, Ida Gray Mining District.

Coolidge, Cyril, and Overpeck, Lem S. The Iron Deposits of the Black Hills of South Dakota.

Goodner, Ivan E. (With Professor C. H. Fulton.) The Constitution of Copper-Iron and Copper-Lead-Iron Mattes.

Ives, Glen P., and Ossa, Ignatio D. Metallurgical Treatment of Jamesonite Ores.

Sparling, Wm., and Winters, F. W. A Hypothetical Mine.

Betterton, J. O. The Determination and Separation of Antimony and Arsenic.

Coolidge, Roy F. The White Precipitates Found in Zinc Boxes.

Jones, H. W. Hvistendahl, E. S. and Read, H. N. The Standby Mine.

Ledyard, L. W. The Cleopatra Mine.

Eddy, John W., and Bennett, R. T. A Hypothetical Mine.

Jeffries, Zay, and Wheelock, H. E. Economic Resources of the Badlands.

Sargent, A. E., and Flower, G. E. The Development of a Hypothetical Mine and the Metallurgical Treatment of the Ore.

Saville, Joseph H. The Possible Development of the Deep Down Property and Treatment of Its Ore.

Stoner, J. W., and Elliot, J. W. A Hypothetical Mine.

Anderson, Wm. L. Investigation of White Precipitate in Zimmerman-Reinhart Method for Iron.

Brooks, Floyd R. Investigation Concerning the Melting Points of a Series of Copper Slags.

Ehle, Chester G. Gypsum Deposits and the Stucco Industry in the Black Hills.

Quinney, E. H., and Winsor, F. H. Jr., Cyanide Tests on a Refractory Siliceous Ore of the Northern Black Hills.

Willard, C. G., and Muhmel, F. J. Investigations of Fire Clays Near Rapid City.

Fahrenwald, Frank A. Report on the Rapid Valley Irrigation Project.

Anderson, Amil A. On the Cambrian Blue Siliceous Ores of the Black Hills.

Alder, Alfred. Experiments with the Quantitative Analysis of Lead.

Hartgering, J. M. Design of a Cement Plant.

Henton, Hugh M. Some Experiments in Analysis of Titanium, Magnesium, Zinc.

Bochert, W. C. Metallurgical Treatment of a Typical Refractory Siliceous Ore.

Eldridge, Robert B. Experiments in Ore Flotation.

Fahrenwald, Arthur W. Report on the Metallurgical Investigation of a Blue Ore.

Farnham, Lloyd L. Experiments on the Fine Grinding and Amalgamation of Jamesonite Ores.

Fleischman, Leo. Data on the Relative Fuel Consumption of Oil and Coal Fired Muffle Furnaces.

Hill, Robert S. Notes on Beryllium.

McCauley, Willard J. An Investigation of the Irrigation Possibilities of Little Elk Creek.

Meents, R. O. Leaching a Copper Ore.

Pryer, W. C. Investigation for a Volumetric Determination for Arsenic.

Stowell, George E. The Geology of Silver City and Vicinity.

Booth, L. E., and Thiel, Arthur. Electrolysis of Alkaline Solutions of Potassium Sulpho-cyanide.

Gates, C. E. The Design of a Plant for a Southeastern Missouri Lead Mine.

O'Harra, B. M. The Gold-Bearing Quartz-Tremolite Series of the Black Hills.

Cragin, Rodney S. Tests for Gold and Silver of the Country Rock of the Black Hills.

Dennis, Paul Joseph. Experiments in Making Brick from the Graneros and Pierre Shales.

Hill, Joseph Henry. The Refining and Recovery of Gold from Dental Scrap.

Smith, Elwyn L. Radio-active Minerals of the Black Hills.

Anderson, Amil. Homestake Stamp Mill Practice.

Bochert, Wm. C., and Price, Virgil T. Flotation of a Gold-Bearing Schist Ore.

Cremer, Frank. Burnt Gumbo and Its Adaptability for Improving the Highways of South Dakota.

Deutsch, Harry. The Metallurgical Treatment of Jamesonite Ore.

Clark, Edwin Espy. Some Changes in the Operating Characteristics of a 10 KW Synchronous Converter, Due to the Reduction of the Air-Gap.

Newbowers, Frank Joseph. Hydro-Electric Development for Farm Installation.

Stout, Herbert A. Experiments in the Treatment of an Arsenopyrite Concentrate.

Wong, Yu Chih. The Electric Treatment of Antimony. (Stibnite Sb_2S_3 from Gillham, Arkansas.)

Nelson, Harold Lee. Some of the Fundamentals Observed in the Improvement of Our Highways.

Hall, Ralph Julius and Mara, Hubert Wilbur. The Utilization of Columbium.

COURSES AND DEPARTMENTS

All engineering courses offered by the School of Mines require four years for completion. They are as follows: Mining Engineering, Metallurgical Engineering, Civil Engineering, and Electrical Engineering.

SYNOPSIS OF COURSES.

MINING ENGINEERING COURSE

First Year.

First Semester—	Hours per Week Lectures.	Lab.
Mathematics 7—Trigonometry	5	
Chemistry 3—General	4	6
Geology 1—General	4	3
English 9—Composition	4	
Civil Engin. 2—Mechanical Drawing		6
	17	15

Second Semester—	Lectures	Lab.
Mathematics 8—Analytic Geometry	5	
Chemistry 4-6—General and Qualitative	4	6
Geology 2—General	4	3
English 10—Composition	4	
Civil Engin. 2—Mechanical Drawing		6
	17	15

Second Year.

First Semester—	Hours per Week Lectures.	Lab.
Mathematics 9—Calculus	5	
Chemistry 7—Qualitative	3	6
Mineralogy 1—General	2	3

Civil Engin. 3—Descriptive Geometry.	1	3
Civil Engin. 5—Surveying	2	6
Mining 1—Breaking ground	3	
	16	18

Second Semester—	Lectures.	Lab.
Mathematics 10—Calculus	5	
Chemistry 8—Quantitative	2	12
Mineralogy 2—Blow-pipe	2	6
Civil Engin. 6—Surveying	3	3
Mining 2—Tunneling, shaft sinking	2	
	14	21

Summer surveying three weeks.

Third Year.

	Hours per Week	
First Semester—	Lectures.	Lab.
Physics 3—General	3	3
Physics 5—Analytic mechanics	4	
Geology 3—Petrography	3	4½
Civil Engin. 7—Topographic drawing		1½
Civil Engin. 9—Machine design		6
Metallurgy 1—General	3	
Mining 3—Ore dressing	3	3
	16	18

Second Semester—	Lectures.	Lab.
Physics 4—General	4	6
Civil Engin. 14—Mechanics of materials	4	
Geology 4—Physical geology	3	
Economics	3	
Metallurgy 2—Assaying	2	9
Civil Engin. 10—Graphics		3
Mining 4—Ore dressing	2	
	18	18

Fourth Year.

	Hours per Week	
First Semester—	Lectures.	Lab.
Elec. Engin. 3—General	4	3
Geology 5—Economic	4	

Mining 5-7—Mine operation	5	
Mining 9—Mine design		6
Metallurgy 3—Gold and silver	2	
Metallurgy 5—Copper	3	
Metallurgy 9—Laboratory		3
Thesis		3
	18	15

Second Semester—	Lectures.	Lab.
Physics 6—Hydraulics	2	1½
Steam Engineering—Power plants and thermodynamics	3	1½
Geology 6—Economic	4	
Mining 6-8—Mining operation	5	
Mining 10—Mine design		6
Mining 12—Mine accounting	2	
Mining 14—Mining law	1	
Metallurgy 4—Iron and Steel	2	
Thesis		6
Metallurgy 12—Mill run		week
	19	15

METALLURGICAL ENGINEERING COURSE

First Year.

	Hours per Week	
First Semester—	Lectures.	Lab.
Mathematics 7—Trigonometry	5	
Chemistry 3—General	4	6
Geology 1—General	4	3
English 9—Composition	4	
Civil Engin. 1—Mechanical drawing		6
	17	15

Second Semester—	Lectures.	Lab.
Mathematics 8—Analytic geometry	5	
Chemistry 4-6—General and qualitative	4	6
Geology 2—General	4	3
English 10—Composition	4	
Civil Engin. 2—Mechanical drawing		6
	17	15

Second Year.

First Semester—	Hours per Week Lectures.	Lab.
Mathematics 9—Calculus	5	
Chemistry 7—Qualitative	3	6
Mineralogy 1—General	2	3
Civil Engin. 3—Descriptive geometry	1	3
Civil Engin. 5—Surveying	2	6
Mining 1—Breaking ground	3	
	16	18

Second Semester—	Lectures.	Lab.
Mathematics 10—Calculus	5	
Chemistry 8—Quantitative	2	12
Mineralogy 2—Blow-pipe	2	6
Civil Engin. 6—Surveying	3	3
Mining 2—Tunneling, shaft sinking	2	
	14	21

Summer surveying three weeks.

Third Year.

First Semester—	Hours per Week Lectures.	Lab.
Physics 3—General	3	3
Physics 5—Analytic mechanics	4	
Chemistry 9—Metallurgical	2	6
Civil Engin. 7—Topographic drawing		1½
Civil Engin. 9—Machine design		6
Mining 3—Ore dressing	3	3
Metallurgy 1—General	3	
	15	19½

Second Semester—	Lectures.	Lab.
Physics 4—General	4	6
Civil Engin. 14—Mechanics of materials	4	
Economics	3	
Metallurgy 2—Assaying	2	9
Civil Engin. 10—Graphics		3
Mining 4—Ore dressing	2	
Metallurgy 4—Iron and steel	2	
	17	18

Fourth Year.

First Semester—	Hours per Week Lectures.	Lab.
Elec. Engin. 3—General	4	3
Metallurgy 3—Gold and silver	2	
Metallurgy 5—Copper	3	
Metallurgy 11—Laboratory		6
Metallurgy 13—Laboratory		9
Mining 5—Mine operation	2	
Thesis		3
Chemistry 11—Electro chemistry	2	
Metallurgy 7—Lead, etc.	2	
	15	21

Second Semester—	Lectures.	Lab.
Physics 6—Hydraulics	2	1½
Steam Engineering—Power plants and thermo dynamics	3	1½
Metallurgy 6—Zinc, etc.	2	
Metallurgy 14—Electrometallurgy	2	
Metallurgy 8—Calculations	2	
Metallurgy 10—Metallurgical design		6
Mining 6—Compressed air	2	
Mining 12—Mine accounting	2	
Mining 14—Mining law	1	
Thesis		6
Metallurgy 12—Mill run		week
	16	15

CIVIL ENGINEERING COURSE.

First Year.

First Semester—	Hours per Week Lectures.	Lab.
Mathematics 7—Trigonometry	5	
Chemistry 3—General	4	6
Geology 1—General	4	3
English 9—Composition	4	
Civil Engin. 1—Mechanical drawing		6
	17	15

Second Semester—	Lectures.	Lab.
Mathematics 8—Analytic geometry	5	
Chemistry 4-6—General and qualitative	4	6
Geology 2—General	4	3
English 10—Composition	4	
Civil Engin. 2—Mechanical drawing		6
	17	15

Second Year.

First Semester—	Hours per Week Lectures.	Lab.
Mathematics 9—Calculus	5	
Physics 3—General	3	3
Mineralogy 1—General	2	3
Civil Engin. 3—Descriptive geometry.		6
Civil Engin. 5A—Surveying	3	6
Mining 1—Breaking ground	3	
	16	18

Second Semester—	Lectures.	Lab.
Mathematics 10—Calculus	5	
Physics 4—General	4	6
Civil Engin. 4A—Descriptive geometry		6
Civil Engin. 6A—Surveying	3	6
Civil Engin. 8—Astronomy	2	
Mining 2—Tunneling, shaft sinking	2	
	16	18

Summer surveying six weeks.

Third Year.

First Semester—	Hours per Week Lectures.	Lab.
Physics 5—Analytic mechanics	4	
Civil Engin. 7A—Topographic drawing		3
Civil Engin. 9—Machine design		6
Civil Engin. 11—Graphics		3
Civil Engin. 13—Railroad engineering	4	3
Civil Engin. 15—Cement and concrete	2	

Metallurgy 1—General	3	
Sociology	3	
	16	15

Second Semester—	Lectures.	Lab.
Civil Engin. 12—Graphics		3
Civil Engin. 14A—Mechanics of materials	5	
Civil Engin. 16—Testing	2	6
Civil Engin. 18—Stereotomy		3
Civil Engin. 26—Sewers	2	
Steam Engineering—Power plants and thermodynamics	3	1½
Metallurgy 4—Iron and steel	2	
Economics	3	
	17	13½

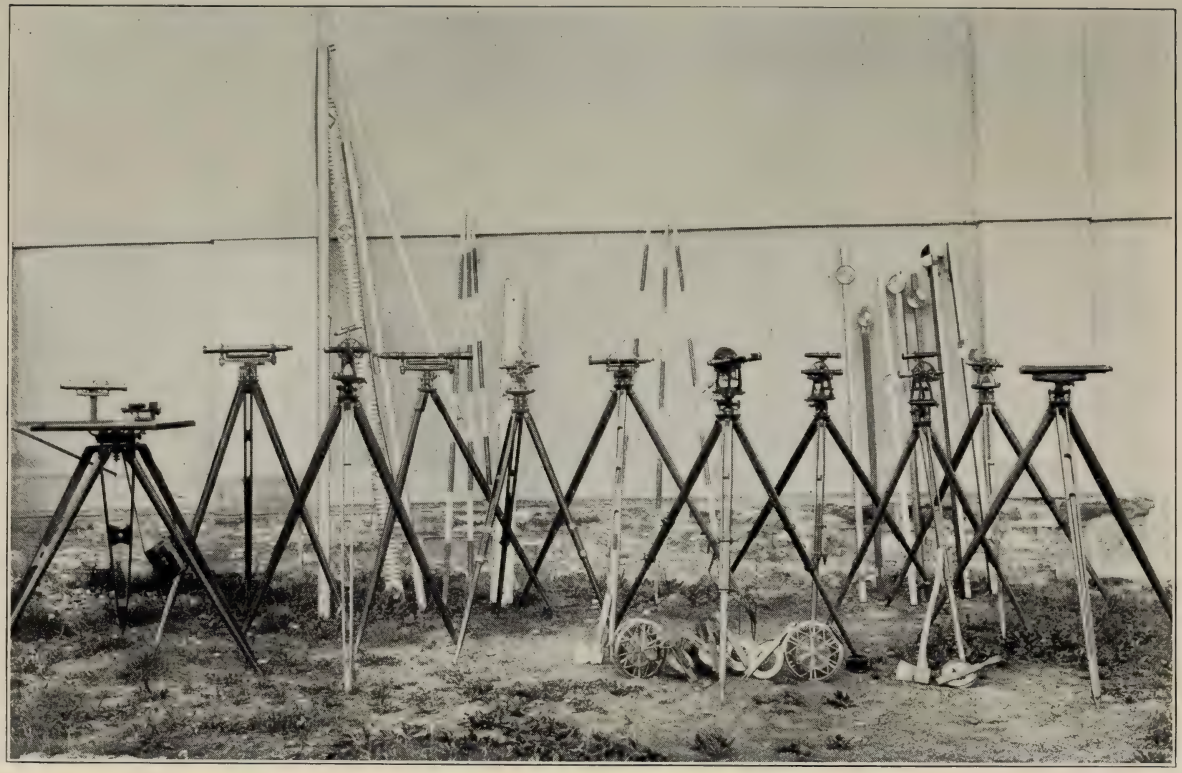
Fourth Year.

	Hours per Week	
First Semester—	Lectures.	Lab.
Elec. Engin. 3—General	4	3
Civil Engin. 23—Roofs and bridges	3	6
Civil Engin. 25—Dams and retaining walls	3	
Civil Engin. 27—Arches and foundations	2	
Civil Engin. 29—Roads and pavements	3	
Civil Engin. 31—Contracts and specifications	1	
Thesis		6
	16	15

Second Semester—	Lectures.	Lab.
Physics 6A—Hydraulics	4	3
Civil Engin. 24—Roofs and bridges	3	6
Civil Engin. 30—Irrigation, water power and supply	5	
Civil Engin. 32—Framed structures	3	3
Thesis		6
	15	18

Geology Class in Dark Canyon.

School of Mines Canyon.



ELECTRICAL ENGINEERING COURSE.

First Year.

First Semester—	Hours per Week Lectures.	Lab.
Mathematics 7—Trigonometry	5	
Chemistry 3—General	4	6
Geology 1—General	4	3
English 9—Composition	4	
Civil Engin. 1—Mechanical drawing		6
	17	15

Second Semester—	Lectures.	Lab.
Mathematics 8—Analytic geometry	5	
Chemistry 4-6—General and qualitative	4	6
Geology 2—General	4	3
English 10—Composition	4	
Civil Eng. 2—Mechanical drawing		6
	17	15

Second Year.

First Semester—	Hours per Week Lectures.	Lab.
Mathematics 9—Calculus	5	
Elec. Engin. 1—Elementary	2	3
Civil Engin. 3—Descriptive geometry	1	3
Civil Engin. 5—Surveying	2	6
Civil Engin 9.—Machine design		6
Physics 3—General	3	3
	13	21

Second Semester—	Lectures.	Lab.
Mathematics 10—Calculus	5	
Elec. Engin. 2—Elementary	2	3
Civil Engin. 4—Descriptive geometry		3
Civil Engineering 6E—Surveying	3	3
Civil Engin. 10—Graphics		3
Physics 4—General	4	6
	14	18

Summer surveying two weeks.

Third Year.

First Semester—	Hours per Week Lectures	Lab.
Mathematics 11—Differential equations	3	
Physics 5—Analytic mechanics	4	
Elec. Engin. 3—General	4	3
Elec. Engin. 5—Measurements		6
Elec. Engin. 3A		6
Sociology	3	
Metallurgy 1—General	3	
	17	15

Second Semester—	Lectures.	Lab.
Physics 6—Hydraulics	2	1½
Steam Engineering—Power plants and thermodynamics	3	1½
Civil Engin. 14—Mechanics of materials	4	
Civil Engin. 16E—Testing laboratory	2	3
Economics	3	
Elec. Engin. 8—A. C. Laboratory		6
Elec. Engin. 10—A. C. Theory	4	
Shop Work 8—Winding laboratory		3
	18	15

Fourth Year.

First Semester—	Hours per Week Lectures.	Lab.
Electro-chemistry	3	
Elec. Engin. 9—Distribution and control	3	
Elec. Engin. 11—A. C. machinery	4	
Elec. Engin. 13—Laboratory		6
Elec. Engin. 15—A. C. Theory	3	
Elec. Engin. 17—Steam electric plants	2	
Electric design		6
Thesis		6
	15	18

Second Semester—	Lectures.	Lab.
Elec. Engin. 12—Hydro-electric plants	3	
Elec. Engin. 14—Laboratory		6

Elec. Engin. 16—Telegraphy and telephony	2	
Elec. Engin. 18—Elec. railways	3	
Elec. Engin. 22—Illumination	2	
Elec. Engin. 24—Management	3	
Electric design		6
Metallurgy 14—Electro-metallurgy	2	
Thesis		6
	15	18

Engineering students wishing to study Spanish or French, have the privilege of taking courses in these subjects by making proper arrangements therefor, providing the total number of lecture hours carried does not exceed eighteen per week.

PREPARATORY SCIENCE COURSE.

The School of Mines has heretofore given a four year Preparatory Science course. Beginning with the school year 1919-1920 only the second, third and fourth years will be given. It is expected that at a later time the second year will also be omitted.

Second Year.

First Semester—	Lectures.	Lab.
Mathematics 3—Geometry	5	
English 3—Rhetoric	5	
History 3—Modern history	5	
Biology 3—Botany	3	3
Shop Work 1 or 3—Woodwork or Forging		3
	18	6

Second Semester—	Lectures.	Lab.
Mathematics 4—Geometry	5	
English 4—Rhetoric	5	
History 4—U. S. History	5	
Biology 4—Botany	3	3
Shop Work 2 or 4—Wood Shop, Molding and Casting		3
	18	6

Third Year.

First Semester—	Lectures.	Lab.
French 1 or Spanish 1	5	
Astronomy	3	3
Biology 5—Zoology	3	6
English 5	5	
	16	9

Second Semester—	Lectures.	Lab.
French 2 or Spanish 2	5	
Biology 6—Zoology	5	3
English 6	5	
Physical Geography	3	3
Freehand Drawing		3
	18	9

Fourth Year.

First Semester—	Lectures.	Lab.
Chemistry 1	3	6
French 3 or Spanish 3, or English 7	5	
Physics 1	4	6
Mathematics 5—Geometry	5	
	17	12

Second Semester—	Lectures.	Lab.
Chemistry 2	3	6
French 4 or Spanish 4 or English 8	5	
Physics 2	4	6
Mathematics 6—Algebra	5	
	17	12

GEOLOGY AND MINERALOGY

Professor O'Harra. Professor Runner

Library, Laboratory and Field Facilities.

A good, well equipped departmental library is placed convenient to the lecture and laboratory rooms and students are required to make intelligent use of the literature contained therein.

The laboratory equipment and the museum collections, elsewhere described, furnish indispensable material for practical work of many kinds.

Field facilities are unsurpassed. Unusual opportunity is offered for study in the field of the various geological horizons, including important and valuable economic deposits. Within a few miles of the school the student may observe upturned strata of nearly all geological ages. Twenty miles southwest of Rapid City is the Harney Peak granite area, with its lavish variety of mineral specimens. Surrounding this is a wonderful exposure of Algonkian metamorphic rocks cut in many places by auriferous quartz veins. The Cambrian, Carboniferous, Triassic, Jurassic, and Cretaceous are extensively developed. The famous White River Badlands of Tertiary age lie to the southeast of the Hills and afford fossils which have made the region known wherever the science of Paleontology is taught. In the northern part of the Hills important igneous rocks, such as rhyolite, phonolite, andesite, dacite, etc., occur in the form of dikes, sheets and laccoliths. Closely associated with these in slates, quartzites, and limestones, gold ores of the greatest importance are found.

In the autumn, short field excursions are made by the class to nearby points of interest and occasionally a visit of several days is made to more distant localities. Thus the student, in addition to lecture and laboratory instruction, has the advantage of systematically directed field study and with the information thus gained, he should be able to undertake for himself the working out of practical field problems.

Geology 1-2.

General Geology: This course is arranged primarily as introductory to all work in geology and mineralogy. It extends throughout the Freshman year and embraces a comprehensive study of the fundamental principles of geology. The course includes brief, but careful study of dynamical, stratigraphical, structural, chemical and historical geology, and is conducted by means of lectures, text books, and laboratory work, and frequent excursions to points of particular interest. Under dynamic geology, the atmospheric, aqueous, igneous, and organic agencies are discussed with reference to their bearing on the present and past condition of the earth's surface. Stratigraphical and structural geology consider the conditions of deposition of sediments and of the disturbance of rock masses. A portion of the time allotted to these subjects is devoted to the study of such minerals and rocks as enter largely into the structure of the earth's surface; also to the methods of geological surveying, including mapping, section making, special problems. Chemical geology includes the study of the general relation which chemistry bears to geological phenomena, such as the formation, metamorphism, and degeneration of rocks, and the origin and alterations of the various kinds of mineral deposits. Under historical geology, the physical history of the earth is discussed, the classification and distribution of sedimentary rocks studied, and the methods of correlation explained. The course aims to equip the student with useful information concerning the phenomena and history of the earth, so that he may know the methods used in geological research, and will better understand how to interpret facts gained in the study of economic deposits.

Freshman Year. Four lecture periods and three laboratory hours per week throughout the year.

Text Book: Pirsson's Text-book of Geology. Miller's Introduction to Historical Geology.

Mineralogy 1.

Crystallography: Eight weeks are given to the study of symmetry, forms and classifications of

crystals. In the laboratory the student becomes familiar with the various types of crystals through the study of models and later is required to identify the forms of one hundred mineral crystals.

Physical Mineralogy: The remainder of the semester is devoted to the physical properties of minerals in general and the composition, forms, properties, occurrence, association, origin and uses of one hundred of the more common minerals are studied in detail. In the laboratory seven hundred unlabeled specimens of the minerals discussed in the class room are determined from their physical properties alone. The course is planned to develop such information as may be needed for the quick and accurate determination of minerals in the field.

Sophomore Year, First Semester. Two lecture periods and three laboratory hours per week. Text: Phillips' Mineralogy.

Mineralogy 2.

General Mineralogy and Blowpipe Analysis: The chemical properties and relations of minerals and the methods of blowpipe and other chemical analysis for their determination are first studied, after which the chemical and physical properties, origin, associations and uses of about one hundred mineral species are taken up, special emphasis being paid to ore and common rock forming minerals. The laboratory work consists of the determination of approximately one thousand four hundred unlabeled specimens of minerals by means of chemical tests and physical properties. A detailed report of all results obtained is made out and kept for reference. It is expected that upon completion of this and the preceding course the student will have gained a good working knowledge of over two hundred of the common minerals, including the chief factors of their distribution, uses, value and output.

Sophomore Year, Second Semester. Two lecture periods and six laboratory hours per week.

Text Books: Phillips Mineralogy; Lewis' Determinative Mineralogy.

Geology 3.

Optical Mineralogy: This course is mainly introductory to the study of Petrography. It aims to enable the student to recognize the common minerals by means of the microscope. A discussion of the principles and phenomena of light, such as reflection, refraction, interference is offered and the different media and their wave fronts, optical signs and indicatrices receive special attention. This is succeeded by an application of these laws in the movement of light in different crystals, and the use of the petrographic microscope in the identification of minerals in thin sections. For laboratory work excellent Zeiss and Leitz microscopes are available. The fairly extensive collection of thin sections includes a special set of 120 oriented mineral sections manufactured by Krantz.

Petrography: This course is intended for mining students who need some training in rock determination, but who have opportunity to devote only a short time to the subject. It embraces the study of rocks, both under the microscope and in hand specimens. The lectures are devoted to a general discussion of the principles of rock classification, special attention being given to the system of Kirkel and Rosenbusch modified as in use in America, which is followed by a brief summary of the Quantitative system. The origin, distribution, mode of occurrence and relations of rock masses and contact metamorphism are included. The principles of regional metamorphism and a classification of metamorphic rocks follow. For the laboratory work a Kranz collection of 350 rocks and thin sections is available. In addition, there is a fairly complete collection of Black Hills rocks, most of which are thin sectioned. There is also a set of unlabeled rocks with accompanying thin sections representing all common types, which are used for description and study by the student.

The Black Hills offer an exceedingly interesting field for the petrographer on account of the great variety of rock types within their small area. When possible field excursions will be taken to points of interest, especially to the metamorphic and igneous areas.

Junior Year, First Semester, Mining Engineering Option: Three lecture periods and four and one-half laboratory hours per week.

Reference books. Manual of Petrographic Methods, Johannsen. Determination of Rock Forming Minerals, Johannsen. Rock Minerals, Iddings. Igneous Rocks, Iddings. Igneous Rocks and Their Origin, Daly. The Natural History of Igneous Rocks, Harker. Petrology for Students, Harker. Lecture Notes.

Geology 4.

Structural Geology: The course begins with a resume of the different hypotheses of earth origin and those concerning the interior condition of the earth. Vulvanism in its broader aspects, its causes and manifestations is next taken up, followed by a brief summary of the modern ideas on diastrophism and isostasy. Rock fractures, flowage, faults and folds are discussed in their relations to deformative stresses and the major units of earth structure in their proper relations. Special attention is given to the solution of problems in faulting and folding that have a bearing on the practical work of the miner.

Junior Year, Second Semester, Mining Engineering Option. Three lecture periods per week.

Reference Texts: Leith's Structural Geology. Leith & Mead's Metamorphic Geology. Lahee's Field Geology.

Geology 5-6.

Economic Geology: This course runs throughout the Senior year and includes study of the origin, modes of occurrence and uses of economic mineral products. About one-half of the first semester is given to the study of non-metallic products. This includes the origin, nature, relations and values of coal, petroleum, natural gas, salines, building stone, clays, cement materials, fertilizers, abrasives, gems, etc. The rest of the course is devoted to the study of metallic products, such as gold, silver, copper, iron, lead, zinc, platinum, mercury, nickel, etc. In this much attention is given to the study of the principles of ore deposition and to the historical development of the theories connected therewith.

Careful attention is given to the chief types of deposits and particularly to localities noted for their wealth of output.

Maps, specimens, and original papers are freely used. Attention is given to the history of mineral development, of the life and comparative importance of various regions and of the influence which economic deposits have exerted upon the regions or countries in which such deposits have been found.

The necessity of individual examination by the student of the best up-to-date literature is insisted upon, and a reasonable ability to properly use such literature is required. Much attention is devoted to the study of the many economic interests of the Black Hills region and observation of the deposits in the field is encouraged.

Senior Year, Mining Engineering Option: Four lecture periods per week throughout the year.

Reference Texts: Beck-Weed's Nature of Ore Deposits; Ries' Economic Geology; Kemp's Ore Deposits of the United States and Canada; Lindgren's Mineral Deposits; Beyschlag, Vogt & Krusch's Ore Deposits. Emmons' Principles of Economic Geology.

CIVIL ENGINEERING.

Professor Mangold.

The aim of this department is to give the student such training in the class room, drawing room, laboratory and field as will properly fit him for entrance to an engineering career.

The endeavor will be to give him enough practical knowledge to enable him on graduation to fill with credit a subordinate professional position and to teach him so much of the underlying theory and principles as to permit him when he has clothed these with experience of his own to rise to the higher ranks of his calling.

The department occupies two well lighted drawing rooms, 24x34 and 24x30 feet in size, lecture rooms and offices. The drawing rooms are furnished with suitable drawing desks which have separate lockers for each student.

The work of this department extends over a period of four years and includes the following courses:

Civil Engineering 1-2.

Mechanical Drawing: Practical work in the drawing room accompanied by lectures as needed. The work is carried on chiefly by means of individual instruction. The course includes the care and use of instruments; the mounting of sheets; simple geometric constructions; orthographic, isometric and cabinet projection, machine details, and both freehand and mechanical lettering of titles. Tracing and blue printing are taught in this course.

Students taking this course should provide themselves with the following list of supplies, most of which may be obtained from the supply room of the department at cost:

One set of drawing instruments containing:
One pair 6-in. compasses, with pen, pencil and needle points.
One pair 6-in. dividers.
One 5½-in. ruling pen.
One 3½-in. steel spring bow divider.

One 3½-in. steel spring bow pencil.
One 3½-in. steel spring bow pen.
One T square with 30-in. blade.
One 4½-in. protractor.
One irregular curve.
One 7-in. 30° by 60° triangle.
One 8-in. 45° triangle.

Drawing paper, pencils, ink, erasers, etc., may be purchased from the department at cost.

French's Engineering Drawing is used as a text book.

Drawing boards and key for locker are furnished by the school on the payment of a fee of $1 per year; 50 cents of this is refunded on return of key and board.

Freshman Year: Six laboratory hours per week throughout the year.

Civil Engineering 3-4.

Descriptive Geometry: This work includes the projection of the point and the line and the representation of planes, with numerous problems relating thereto, and the generation, classification and intersection of curves and surfaces. Drafting room work with individual talks.

Sophomore Year, First Semester. One lecture and three laboratory hours per week; second semester, three laboratory hours per week.

Text Book: Highbee's Descriptive Geometry.

Civil Engineering 4A.

Descriptive Geometry: Similar to Civil Engineering 4, but including shades, shadows, and perspective.

Sophomore Year, Second Semester: Six Laboratory hours per week.

Civil Engineering 5-6

Surveying. Plane Surveying. It is the desire of the department to bring, as far as it is practicable, theory and practice side by side. Ample opportunity for field work is provided and the institution is provided with all the instruments and ac-

cessories necessary to carry on the work. Additional instruments are purchased as the need for them arises.

For the performance of the field work, the class is divided into squads with just sufficient number in each party to properly carry on the work. Each student is required to take his turn at every part of the work; to use each instrument as the occasion demands; to make his notes and computations; and finally to accurately plot them in the drawing room.

The course outlined is as follows: Linear measurements by means of pacing and chain or tape; adjustment and use of the engineer's transit and level; traversing; principles of land surveying; adjustments and use of the plane table; adjustment and use of the solar instrument; topographic surveying, determination of the meridian by means of the solar instrument; direct solar observation and observation on Polaris; measurements of volumes. Railroad surveying and city surveying will receive as much time as the conditions will permit. Trigonometry is a prerequisite.

Mine Surveying: The location and patent survey of minerals claims; carrying the meridian underground via vertical and inclined shafts; underground traversing and leveling; underground connections; measurements of ore reserves and stope volumes; note taking and plotting.

Sophomore Year: Two lecture periods and six hours field work per week during the first semester and three lectures and three hours field work during the second semester.

A three weeks' summer school for practical work immediately follows the close of school in June. This includes two weeks of plane surveying and one week of mine surveying underground.

Text Book: Tracy's Plane Surveying.

Civil Engineering 5A-6A

Surveying: Course similar to Civil Engineering 5-6, but amplified for Civil Engineering students. In addition to the subjects mentioned under the preceding course, this course treats of geodetic surveying including base line measurement, triangulation

and measurement of angles, trigonometric and precise leveling and map projection.

Three hours lectures and six hours field work per week during the Sophomore year, followed by six weeks summer field work.

Civil Engineering 6E

Plane Surveying: Same as Plane Surveying under Course 6, but does not include Mine Surveying. Sophomore Year. Electrical Engineering Course, Second Semester. Three hours lectures per week for one half semester; three hours field work per week for one semester, followed by two weeks summer field work.

Civil Engineering 7

Topographic Drawing: This work embraces the accurate drawing of maps, including topographic features, and the plotting of profiles. Many of the notes taken in the preceding summer's field work are thus worked up in the drafting room.

Prerequisite Civil Engineering 5-6.

Junior Year, First Semester: Three laboratory hours per week for eight weeks.

Civil Engineering 7A

Topographic Drawing: This course includes the same subjects as Course 7, but the work is amplified for Civil Engineering students. Prerequisite Civil Engineering 5A-6A.

Junior Year, First Semester: Three laboratory hours per week.

Civil Engineering 8

Astronomy: A short course in Field Astronomy for Civil Engineering students, special attention being given to the observations for azimuth, latitude, longitude and time. The school possesses a superior three inch astronomical telescope with achromatic finder and four eye pieces. Sophomore year, Second Semester: Two lecture periods per week.

Civil Engineering 9

Machine Design: The drawing of screw threads, keys, fastenings, the various forms of gear teeth, bevel gears, bearings, cams, quick return motions, etc. It is designed to make this course eminently practical, an introduction to those problems which continually meet the designing engineer and which the principles of machine design alone will help him to solve. Drafting room work with talks as needed and library references.

Junior Year, First Semester: Six laboratory hours per week.

Civil Engineering 10-11-12

Graphical Statics: The object of this course is to give an understanding of the theory of the graphical solution of internal stresses in a framed structure, arising from steady and moving loads, from the pressure of the wind, etc. The student is required to determine by graphical methods on the drawing board, the nature and amounts of internal stresses in the various members of such simple roof and bridge trusses and head frames as are assigned him.

Junior Year: Three laboratory hours per week. Courses 11-12 is for Civil Engineering students and extends throughout the year. Course 10 is for all other students and is given during the second semester.

Text Book: Malcolm's Graphic Statics.

Civil Engineering 13

Railroad Engineering: The organization of a railroad company, the permanent way, rails, ties, roadbed, ballast, bridges, culverts, yards, elevation of outer rail, signals, locomotives, curves and grade problems, surveying for location and construction. Plane surveying is a prerequisite. Raymond's Elements of Railroad Engineering is used.

Junior Year, First Semester, Civil Engineering Course. Four lecture hours and three laboratory hours per week.

Civil Engineering 14

Mechanics of Materials: The resistance and elasticity of the materials of engineering; fundamental assumptions of the common theory of beams; distribution of stresses in beams; shearing forces, bending moments, and deflections of beams; the theory of torsion, flexure, elastic limits; working stresses and ultimate stresses and ultimate resistance of cast iron, wrought iron, steel and timber; pipes and riveted joints; posts and columns; the design of posts, beams, shafts, etc.

Junior Year, Second Semester: Four lecture periods per week.

Text Book: Boyd's Strength of Materials.

Civil Engineering 14A

Mechanics of Materials: This is a somewhat more extended course than the preceding, and is given five lecture hours per week. It includes all the work given in the text book above mentioned.

Junior Year, Second Semester, Civil Engineering Course.

Civil Engineering 15

Cement and Concrete: The composition, manufacture and use of Portland and natural cements, the mixing and placing of plain and reinforced concrete, the theory and calculation of reinforced concrete.

Junior Year, First Semester, Civil Engineering Course. Two lecture periods per week.

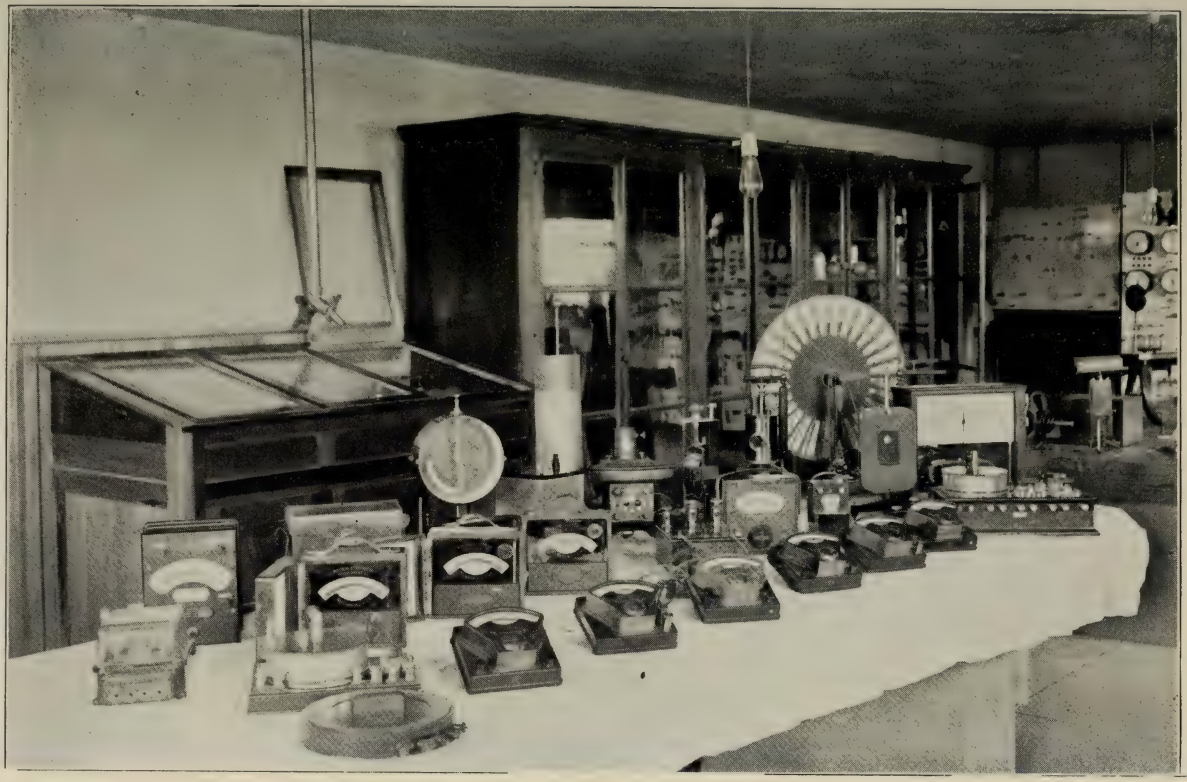
Civil Engineering 16

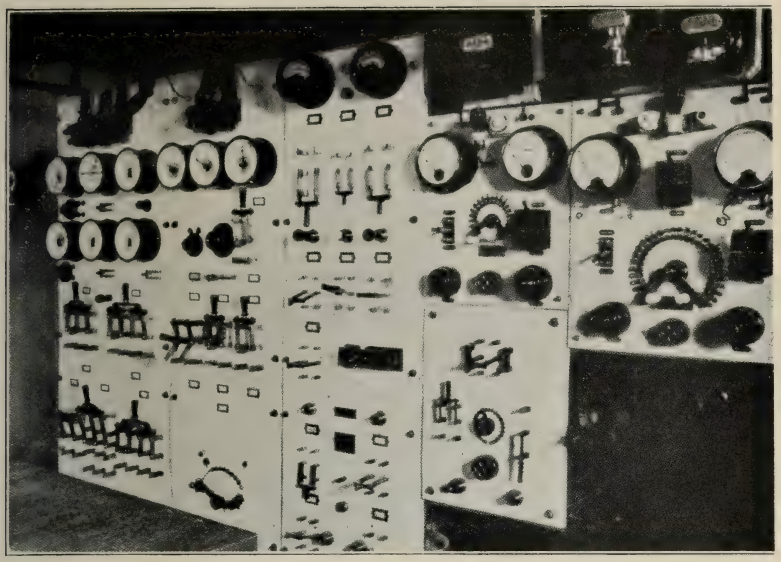
Testing Materials: A laboratory course with explanatory lectures. Must be accompanied or preceded by Civil Engineering 14 or 14A.

Junior Year, Second Semester, Civil Engineering Course. Two hours lectures and six hours laboratory work per week.

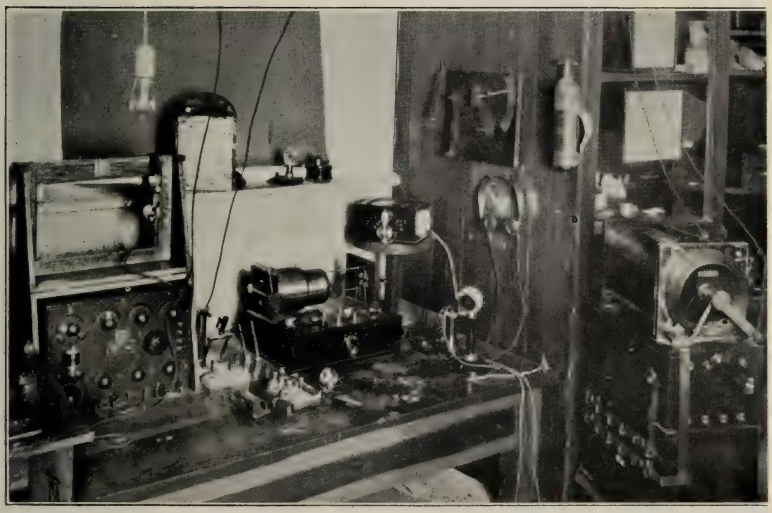
Civil Engineering 16E

Testing Materials: A course for Electrical Engineering students, similar to Civil Engineering 16,





Electric Switchboard in Physics Laboratory.



Wireless Apparatus

but with the laboratory work abridged to three hours per week. Second Semester, Junior Year.

Civil Engineering 18

Stereotomy: Drafting room work with lectures as needed. Descriptive geometry applied to the detail drawing of masonry arches and other structures with plane, curved or warped surfaces. The drawing room courses of the first two years are prerequisites.

Junior Year, Second Semester, Civil Engineering Course. Three laboratory hours per week.

Civil Engineering 23-24

Roofs and Bridges: A study of the usual designs of roof and bridge trusses, with calculations of stresses and drawing room work in design. Must be preceded by Civil Engineering 11-12.

Senior Year, Civil Engineering Course. Three lecture periods and six laboratory hours per week during the year.

Civil Engineering 25

Dams and Retaining Walls: A study of various types of dams and weirs, including timber, earth, masonry and rock fill dams, and of retaining walls.

Senior Year, First Semester, Civil Engineering Course. Three lecture periods per week.

Civil Engineering 26

Sewers: The various ways of disposal of sewage, sewer design and construction.

Junior Year, Second Semester, Civil Engineering Course. Two lecture periods per week.

Civil Engineering 27

Arches, Masonry and Foundations: The theory and design of arches, the methods and materials of construction of foundations and masonry structures.

Senior Year, First Semester, Civil Engineering Course. Two lecture periods per week.

Civil Engineering 29

Roads and Pavements: The modern construction of earth roads, country highways, city streets and pavements, materials, methods, economics and costs.

Senior Year, First Semester, Civil Engineering Course. Three lecture periods per week.

Civil Engineering 30

Irrigation, Water Power and Supply: The storage and distribution of water for irrigation and power. Water works for small cities.

Senior Year, Second Semester, Civil Engineering Course. Five lecture periods per week.

Civil Engineering 31

Contracts and Specifications. A course of one hour per week of reading and recitations.

Senior Year, First Semester, Civil Engineering Course.

Civil Engineering 32

Framed Structures: Structural details, the principles of detail, design of members and joints in timber and steel construction.

Senior Year, Second Semester, Civil Engineering Course. Three lecture periods and three laboratory hours per week.

PHYSICS AND ELECTRICAL ENGINEERING

Professor Swisher Instructor Clark

The courses in Physics are designed to give to the student a broad, general knowledge of the whole subject, as well as the knowledge most essential to the work in his branch of engineering.

In Electrical Engineering the courses of the first three years are intended to lay the foundations for study in both direct and alternating current work. During the fourth year more specialized courses are offered, giving opportunity to apply the general principles to more technical problems.

The courses offered by the department are as follows:

Physics 3

Mechanics of Solids and Fluids, Sound and Heat: In mechanics especial attention is given to the empirical and practical aspects of the subject, while the more theoretical results are considered in Physics 5. Particular emphasis is laid upon the laws of motion, friction, work and energy, and hydro-mechanics.

In heat particular attention is given to the expansion of gases and vapors, specific heat, and to the energy relations of heat, giving the student a good foundation for Thermodynamics.

The aim of the laboratory work in this and the following course is not so much to perform a large number of experiments as to learn to work with care and accuracy. Determinations are made of the co-efficient of friction, specific gravity, velocity, rate of vibration and analysis of sounds.

In heat especial attention is given to the determination of specific heat, heat of fusion, heat of vaporization, melting and boiling points, coefficient of expansion of solids, liquids and gases, and the determination of the mechanical equivalent of heat, and the plotting of cooling and freezing point curves.

First Semester: Sophomore Year for Civil and Electrical Engineers, Junior Year for Mining and

Metallurgical Engineers. Three lecture periods and three laboratory hours per week.

Text Book: Reed and Guthe-College Physics.

Physics 4

Magnetism and Electricity, Light: The subject of electricity receives detailed consideration. The laws of electrostatics, resistance, electrolysis, electromagnetism and electromagnetic induction are considered in detail, and a careful study of the theory of electrical measurements is made.

The subject of light is considered from the standpoint of the electromagnetic theory and a careful study is made of reflection, refraction, dispersion, interference, diffraction and polarization and of the theory of optical measurements.

In the laboratory special emphasis is placed on electrical work and optical instruments. The laboratory is well equipped for that work.

The school machine shop is at the disposal of students for the purpose of constructing apparatus for research work.

Second semester, as above. Four lecture periods and six laboratory hours per week.

Physics 5

Analytic Mechanics: In this course the fundamental principles of mechanics are developed and a large number of problems are worked giving the practical applications of these principles to engineering. Special effort is made to develop in the student the ability to attack and work out problems for himself. Calculus methods are used freely when needed.

Some of the more important topics taken up are as follows: Composition and resolution of forces; conditions of equilibrium; centers of gravity, moments of inertia; laws of motion; friction; work and energy.

Junior Year, First Semester. Four lecture periods per week.

Physics 6

Hydraulics: The student takes up this course with a knowledge of hydrostatics from his work in

Physics 3, and is thus prepared to commence with hydraulics proper, or the study of the laws governing the motion of water.

The school is favorably situated for field work in hydraulics. Rapid creek is a mountain stream with a fall of about 1.6 per cent., offering splendid facilities for wier and velocity measurements; two large irrigation ditches are adjacent to the school. and Rapid City has three water-power plants within the city limits. The students thus have opportunity to visit and study hydraulic power plants in successful operation.

Senior Year, Second Semester: Two lecture periods per week, and three laboratory hours per week for eight weeks. Junior Year for Electrical Engineering students.

Text Book: Mansfield Merriman's Treatise on Hydraulics.

Physics 6A

Hydraulics: A more extended course than Physics 6, for Civil Engineering students.

Senior Year, Second Semester. Four lecture periods and three laboratory hours per week.

Electrical Engineering 1-2

An elementary course in electrical manipulation for Electrical Engineering students including telephone and telegraph circuits, wiring, bells, wiring diagrams and elementary machine connections. Sophomore Year, Electrical Engineering Course. Two lecture periods and three laboratory hours per week.

Electrical Engineering 3

This course deals with the principles and general construction of dynamo electric machinery, systems of direct current distribution; direct current motors, their action control and application; the principles and general construction of alternating dynamo electric machinery; systems of alternating current distribution, and alternating current motors. In the laboratory, practice is acquired in the use of

instruments in the operation and testing of direct and alternating current generators, motors and transformers.

First Semester, Junior Year of Electrical Engineering Course, Senior Year of all other courses: Four lecture periods and three laboratory hours per week throughout the semester.

Text Book: Gray, Principles and Practice of Electrical Engineering.

Electrical Engineering 3A.

This course is taken parallel with and is intended to be supplementary to Course 3 for Electrical Engineers.

Junior Year, First Semester, Electrical Engineering Course. Two hours per week.

Electrical Engineering 5.

Electrical Measurements: Junior Year Electrical Engineering Course. Six laboratory hours per week during the first semester.

Electrical Engineering 8

Alternating Current Laboratory, Junior Year, Second Semester, Electrical Engineering Course: Three laboratory hours per week.

Electrical Engineering 10

Alternating Current Theory: In this course the fundamental principles underlying alternating current calculations are developed. A large number of problems applying these principles are worked out and discussed at length.

Junior Year, Second Semester, Electrical Engineering Course. Four lecture periods per week.

STEAM ENGINEERING

Thermo-Dynamics: This course begins with a discussion of the theory underlying the operation of heat engines. The theory of operation of the ideal engine is developed, and the principles governing the action of steam and gas engines, air compressors and refrigerating machines are fully discussed.

Power Plants: This course applies practically the principles developed under thermodynamics. It embraces the history of the development of the steam engine, and a study of the types in successful use; the application of the indicator and the Prony brake; the study of the steam boiler, and the testing of boilers and fuels. A Thompson indicator, a Prony brake with Fairbanks scales, a Standard Crosby test gauge, and a Carpenter steam separating calorimeter are available for laboratory work.

The school has three boilers aggregating 250 horse-power, and a 40 horse-power Corliss engine; also a gasoline and a kerosene engine. This apparatus is also available for laboratory work in this course.

Second Semester. Junior Year for Civil and Electrical Engineering Courses, Senior Year for Mining and Metallurgical Engineering Courses. Three lecture periods per week for the semester and three laboratory hours per week for a half semester.

WIRELESS TELEGRAPHY

The Physics Department is also in charge of the School of Mines Radio Station. This station is completely equipped with up to date sending apparatus and two complete receiving sets. One of these is for arc, or continuous waves, and has a guaranteed receiving radius of 9,000 miles. The other is for spark, or damped wave, signals. This is intended for shorter range than the other, but we have copied messages from all parts of the United States with it.

Effort is made to keep in step with the most recent developments in this relatively new branch of electrical work and the new apparatus is being added as needed to keep it up to date.

CHEMISTRY.

Professor Bisson.

The courses in Chemistry are designed to give to engineering students the knowledge of chemistry most essential to their work. The subject is given in all courses according to the modern electrolytic dissociation theories. The purpose is to excite in the student an interest in experimentation, to culvate methods of accuracy and rapidity in manipulation and to teach the proper correlation of the results of experiments.

Chemistry 3-4.

General and Elementary Physical Chemistry. This course is designed to give the student a knowledge of the theories and laws of the science as well as to increase his knowledge of general chemistry facts. Before entering this class the student must have had either Chemistry 1 and 2 (see Preparatory Announcement) or a good high school course in Chemistry. The following subjects are discussed: atoms and molecules, gases, liquids and solids, solutions, thermo- and electrochemistry. Special attention is given to the theories of electrolytic dissociation and the law of dissociation and the law of mass action. The laboratory work in the first semester is designed to show the application of some of the principal generalizations.

Freshman Year. First Semester: Four lecture periods and six laboratory hours per week. Second Semester: Two lecture periods per week.

Text: W. A. Noyes Text-book of Chemistry.

Chemistry 6.

Qualitative Analysis: The work in qualitative analysis begins with an outline of the general scheme of analysis. A minute study of the separation and detection of the common acids and bases follows. Emphasis is placed upon the general principles of chemistry involved, especially the electro-

lytic dissociation theory and the mass action law. The aim of this course is to teach the student the reasons for every step in the separation and identification of the elements and to develop the idea of quantity as well as quality.

Freshman Year, Second Semester. Two lectures and six laboratory hours per week.

Text Book: A. A. Noyes' Qualitative Chemical Analysis.

Chemistry 7.

Advanced Qualitative Analysis. An advanced course to follow Chemistry 6. The methods of analysis of commercial products and minerals are discussed fully. The detection of a number of the rarer elements is also a part of this course. The quantitative idea is emphasized.

Sophomore Year, First Semester. Three lectures and six laboratory hours per week.

Chemistry 8.

Quantitative Analysis. This course covers the general principles of quantitative analysis and includes the analysis of simple substances by both gravimetric and volumetric methods. The subject of chemical calculations is discussed and problems are solved.

Sophomore Year, Second Semester. Two lecture periods and twelve laboratory hours per week.

Text: Talbot's Quantitative Analysis.

Chemistry 9.

Metallurgical Chemistry: This course is to familiarize the student with the analytical methods used in conjunction with metallurgical processes. Especial reference is made to the analyses for the rare elements found in the Black Hills region, and to the technical methods connected with the metallurgy of iron, steel, zinc, lead and copper.

Junior Year, First Semester. Metallurgical Engineering Course. Two lecture periods and six laboratory hours per week.

Text: Lord & Demorest's Metallurgical Chemical Analysis.

Chemistry 11.

Electro-chemistry. Theoretical and Applied. Senior Year, First Semester. Metallurgical and Electrical Engineering Courses. Two lecture periods per week.

Chemical Research

Opportunity will be given for original research work along chemical lines to students qualified to undertake such work.

METALLURGY.

Professor Traphagen.

Metallurgical subjects are taught by lecture courses with frequent reference to standard works on the subject, and to the current literature.

The lectures are supplemented, as far as possible, by laboratory work and experiments, and by excursions to neighboring metallurgical works. The school is favorably situated in being contiguous to an active gold mining district, the Black Hills, affording excellent opportunity to study the practical side of metallurgy, particularly that of gold, on a large scale and at close range. The stamp mills and cyanide plants of Lawrence county are easily reached by rail in two hours' time.

A well equipped metallurgical laboratory is available for use, and it is desirable that the student should be thoroughly trained in the basic scientific principles of metallurgy. With actual metallurgical operations, on a large scale, the student becomes familiar to such an extent as is desirable during his school years, by visits to the working plants of the district.

In the laboratory he becomes acquainted with the use of pyrometers, calorimeters, microscopes for the examination of metals and furnace products and other scientific metallurgical apparatus. He conducts experiments in the refining and heat treatment of steel, electric deposition of metals, formation of slags, refining of metals, cyanide process and amalgamation, etc. He becomes experienced to some extent with actual working of a furnace, stamp mill, concentrating tables and cyanide plant with which the laboratory is provided.

The department is equipped with a card index of metallurgical literature, which covers all of the subjects of interest completely, and is at the service of students.

Metallurgy 1.

Introductory Metallurgy: This course consists of lectures on the physical properties of metals; on alloys, their types, nature and properties; fuels;

combustion; refractory materials, thermal measurements; discussions of metallurgical principles, slags and furnace products and their nature; types of furnaces and furnace construction; the means of supplying and heating blasts; thermo-chemistry, including a discussion of chemistry at high temperatures; typical metallurgical processes and the general economic considerations of metallurgy, such as buying and selling ores and metallurgical products. Students are required to do outside reading from references given in the class room and hand in for examination papers on topics assigned. Laboratory work covering part of this course is carried out in the Senior Year, and is described under Metallurgy 11.

Junior Year, First Semester: Three lecture hours per week.

Text-book: Hofman, General Metallurgy.

Metallurgy 2.

Assaying: This course is taught by lectures and by laboratory work, based on the lectures. Elementary chemistry, qualitative and quantitative analysis are prerequisites, being necessary for a thorough understanding of the work.

The work of the laboratory includes assaying of reagents, the testing of ores to discover their nature; the study of oxidizing and reducing reactions occurring in assaying; the study of typical assay slags; the assaying of pure gold and silver ores by crucible and scorification methods; the special assaying of copper and zinc ores containing gold and silver; the assaying of arsenical and antimonial ores for gold and silver; the study of cupellation and the factors which influence its results; the assaying of impure ores by the roasting, the nitre, and excess litharge methods; the assaying of telluride ores, lead bullion, and cyanide precipitates for gold and silver; the assaying of gold and silver bullion; the assaying of ores and alloy for platinum, iridium, etc.; the assaying of lead, tin, bismuth and antimony ores for their respective base metals; the dry assay of mercury ores for mercury; and concentration and free milling tests on a laboratory scale.

Junior Year, Both Options, Second Semester: Two lecture periods and nine laboratory hours per week.

Text-book: Fulton, Manual of Fire Assaying.

Metallurgy 3.

The Metallurgy of Gold and Silver: This course consists of lectures on the metallurgy of gold-silver, taking up first, modern stamp mill practice, discussing in detail mortar boxes, stamps, screens, general battery construction, etc., and the influence of weight of stamp, screen mesh, mortar box dimensions, amount of water, on results obtained. Inside and outside amalgamation is studied in detail; the general mill arrangements; clean up; the influences of other processes following amalgamation is discussed. Modern fine grinding in tube mills and other apparatus is investigated. This is followed by a discussion of the cyanide process for gold and silver ores; wet and dry crushing; crushing in cyanide solution; the separation of sands from slimes; the treatment of sands by percolation; the treatment of slimes by decantation, filter pressing and vacuum filtration; the precipitation of gold and silver by the various methods in use, methods of cleaning up, and the smelting of cyanide precipitates. The general chemistry of cyanidation is discussed. The chloridizing roasting of silver ores; pan amalgation; leaching process for silver ores, etc., concludes the course.

Senior Year, Mining and Metallurgical Engineering Course, First Semester. Two lecture periods per week. Lecture notes.

Reference works: Julian & Smart, Cyaniding of Gold and Silver Ores; Henry Louis, Handbook of Gold Mining; T. K. Rose, Metallurgy of Gold; Del Mar, Stamp Milling; McFarren, Cyanide Practice; Clennel, The Cyanide Handbook; Thomson, Stamp Milling and Cyaniding.

Metallurgy 4.

Iron and Steel: This course consists of lectures on iron alloys, their classification, structure, properties, metallography; taking up more particularly iron and steel. The hardening and tempering of

steel is taken up in detail. The metallurgy of cast iron, wrought iron and steel is discussed in principle, but not in great detail. Especial attention is paid to the principles and chemistry of the iron blast furnace to the Acid Bessemer process, and to the Acid and Basic Open Hearth processes. Statistics of the iron and steel industry are given. The student is required to do considerable outside reading.

Junior Year, Both Options, Second Semester: Two lecture periods per week. Lecture notes.

Metallurgy 5.

The Metallurgy of Copper: This course consists of lectures on the modern metallurgy of copper It discusses the types of copper ores and the methods suitable for the treatment of the different types. The principles of the reverberatory process for copper are discussed in detail, as they bring out clearly the chemistry of copper. Matte smelting for copper ores is discussed, both pyrite smelting and ordinary matte smelting being taken up in detail; also the roasting of copper ores. This is followed by the discussion of the Bessemerizing of copper mattes and the electrolytic refining of blister copper. Wet methods for copper ores are discussed.

Senior Year, Mining and Metallurgical Options, First Semester: Three lecture periods per week.

Reference works: Peters, Modern Methods of Copper Smelting; Schnabel, Handbook of Metallurgy; Peters, Principles of Copper Smelting.

Metallurgy 6.

Zinc, Nickel, Tin, Mercury, etc. A series of lectures dealing with the theory and practice in the treatment of the above mentioned and other metals.

Senior Year, Metallurgical Option, Second Semester: Two lecture periods per week.

Metallurgy 7.

Lead, Cadmium, Bismuth and Antimony. Lectures treating of the smelting of lead ores in the open hearth, reverberatory and blast furnaces, including the roasting of ores, composition of lead

slags, the products of the furnace, etc. The practice of large centrally located plants, treating both mixed lead and copper ores is taken up, also the desilverization of lead bullion, and the refining of lead.

The metallurgy of cadmium, bismuth, and antimony is also considered.

Senior Year, First Semester, Metallurgical Option. Two lecture periods per week.

Metallurgy 8.

Metallurgical Calculations: A course based on Richards' Metallurgical Calculations. It is designed to make the student familiar with the more important calculations in connection with the practice of thermo-chemistry, copper smelting, lead smelting and electro-metallurgy.

Metallurgical Option, Senior Year, Second Semester. Two lecture periods per week.

Metallurgy 9.

Metallurgical Laboratory: Laboratory practice in pyrometry; calibration of the thermo-couple with the use of potentiometer; the roasting of ores, noting the formation of sulphate, etc.; the desilverization of base bullion by the Parkes process. Special problems according to the requirements of individual students.

Senior Year, First Semester, Mining Option: Three laboratory hours per week.

Metallurgy 10.

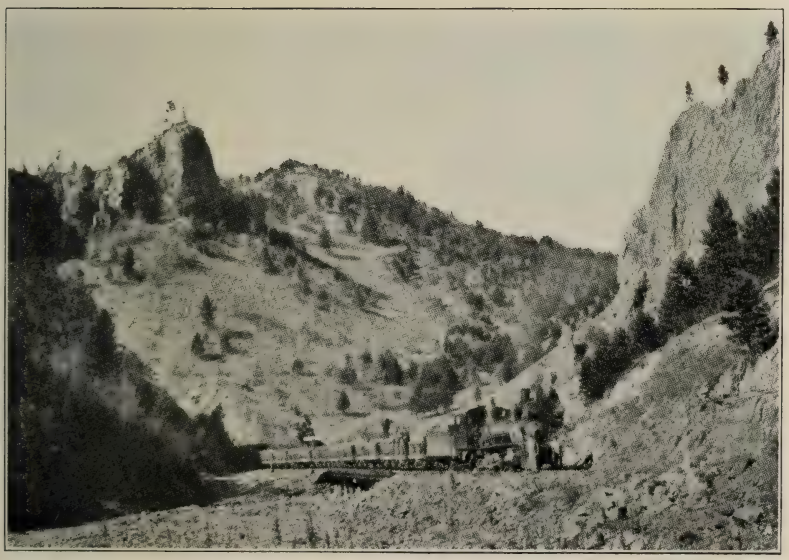
Metallurgical Design: The design of chimneys, cyanide tanks, stamp cams, zinc boxes, mortar box and block, 5 stamp battery, 10-stamp amalgamating concentrating mill, wood construction, dust chamber, copper blast furnace, copper reverberatory furnace, cyanide plant to treat a given ore; data to be collected from tests in the cyanide laboratory.

Senior Year, Metallurgical Option: Six laboratory hours per week for the second semester.

Metallurgy 11.

Metallurgical Laboratory: Course similar to Metallurgy 11, but amplified.

General View of the Gold Ruby Basin.



Ore Train from the Bald Mountain District

Senior Year, Metallurgical Option, First Semester: Six laboratory hours per week.

Metallurgy 12.

Metallurgical Laboratory: One unbroken week spent in the metallurgical laboratory on work assigned by the department.

Senior Year, Both Options, Second Semester: Forty-eight hours.

Metallurgy 13.

Metallurgical Laboratory: Testing of ores for the cyanide process. The student will have thorough training in the testing of ores for the purpose of ascertaining the best methods of treatment of a given ore. The data obtained will be used in the work in the drafting room in the course in Metallurgical Design.

Senior Year, Metallurgical Option, First Semester; Nine laboratory hours per week.

Metallurgical Research.

Research Work: Times and fees by arrangement.

Metallurgy 14.

Electro-Metallurgy: Electrolytic processes. Theory, Electrolytic processes for copper, gold silver, lead, nickel and tin.

Electrothermic processes. Theory, The electric furnace for iron and steel, ferro-alloys, carbides, aluminium, zinc, and for miscellaneous purposes.

Senior Year. Metallurgical and Electrical Option, Second Semester: Two hours per week.

MINING.

Professor Bochert.

The instruction in Mining is given by lecture courses, illustrated by lantern views, photographs and drawings; by frequent reference to standard works and current literature; by experimental work on various types of ores, carried on in the mining laboratory, and by excursions to nearby mines and mills for the purpose of observing and noting actual conditions of practice.

The department enjoys to an unusual degree, those advantages which naturally accrue from the school's location. Being contiguous to a world famous mineral region, the nearness of large producing mines means much, while the wholesome mining atmosphere in which the student lives, furnishes a never failing supply of food for enthusiasm and interest.

The mining and metallurgical laboratory of the school, which has proven a most valuable adjunct to the work of instruction, is fully equipped with modern appliances of approved design. The operations attendant upon the preliminary treatment of various types of ore are here carried out by the students on a scale approaching commercial practice.

Special field work in mining is held each year in April. A suitable mining locality having been selected, students under the direction of instructors devote one week to the study of practical mining, both above and below ground, systematic note taking and careful sketching of all principal features being a requirement. Attendance upon this work is obligatory with all members of the Senior class.

The uniform courtesy and good will shown by the management of mining enterprises throughout the region to instructors and students indicates a wholesome regard for the efforts of the department and constitutes one of its most valuable assets.

The following courses are offered by the department:

Mining 1.

Boring: The use of the earth auger, drive pipe, etc., in the boring of holes for wells and for prospecting purposes; the boring of deep holes by the churn drill and drop tool, also by the diamond and other rotary drills; the survey of bore holes; the cost of boring.

Breaking Ground: The excavation of earth and rock in general; hand tools; mechanical earth excavators; rock drills and their use; channelers; coal cutters, steam shovel; dredges, etc.; estimates and costs.

Explosives: Black powder, nitro-glycerine, gun cotton and their derivatives; methods of testing the force of explosion and heat developed; pointing and charging of holes; methods of firing; cost of blasting operations.

Sophomore Year, First Semester: Three lecture periods per week.

Mining 2.

Tunnelling: The driving of mine tunnels and drifts through rocks and through soft or running ground; comparative costs, general discussion of the methods used in driving large tunnels for railroad and other purposes.

Shaft sinking: The sinking of shafts for mining purposes through soil, rock, quicksand and other water-bearing strata, by approved methods; costs of same.

Sophomore Year, Second Semester: Two lecture periods per week.

Mining 3-4.

Ore Dressing: The principles of ore crushing with description of the various types of crushing machinery; screens and the principles of screen sizing; stamp milling and amalgamation; the theory and practical application of the dressing of ores by water currents, including description of the principal forms of classifiers; jigs and the laws of jigging; concentrating tables; slime treatment and the machinery for its accomplishment; magnetic concentration; concentration by oil; dry concentration;

general discussion of the continental and English systems of ore dressing and their American modifications; the description and study of typical ore dressing plants.

Junior Year, First Semester: Three lecture periods and three laboratory hours per week.

Second Semester: Two lecture periods per week.

Mining 5.

Drainage: Sources of mine water; dams and drainage levels; hoisting of water; Cornish and direct acting pumps; centrifugal pumps; use of compressed air and electricity in pumping operations; special examples and costs.

Transportation: Underground and surface haulage; vehicles and motive power; self-acting and engine planes; tail rope and endless rope systems of haulage; electric and pneumatic haulage; surface tramways and aerial ropeways.

Senior Year, First Semester: Two lecture periods per week.

Mining 6.

Compressed Air and Its Uses: The modern air compressor with accessories and the laws under which it operates; conveyance of compressed air in pipes; effect of altitude; air compression by the direct action of falling water; calculations; costs.

Senior Year, Second Semester: Two lecture periods per week.

Mining 7.

Exploitation: The extraction of mineral by open works, by wells and bore holes; the underground working of veins, bedded deposits and masses by methods best suited to each; conditions affecting the choice of methods; cost of ore extraction.

Supporting Excavations: The use of wood, metal and masonry in the lining of shafts and other excavations, their relative cost, strength and durability; the timbering of stopes, stations and other working places underground; the preservation of timber.

Hoisting: Hoisting engines, their construction and chief features; methods of equalizing the load

moment on the engine; ropes, cages, skips and safety appliances; gallows frames, pneumatic hoisting; costs.

Senior Year, First Semester. Three lecture periods per week. Mining Engineering Option.

Mining 8.

Ventilation: Natural and induced ventilation; furnaces and fans; friction of air in mines; control of air currents; efficiency of ventilating apparatus.

Lighting: Open lights, safety lamps, the electric and other lights used in underground illumination.

Placer mining: Sluices, riffles, pipe lines, nozzles and hydraulic elevators, their construction and use; river dredging, costs and results.

Senior Year, Second Semester: Three lecture periods per week. Mining Engineering Option.

Mining 9-10.

Design of Mining Plant: The student is given certain data relative to an hypothetical mine, such as maximum depth of hoist, capacity of hoisting, etc., from which he calculates the power needed, selects the type and size of hoisting engine, makes calculations as to the size of reel for flat rope, and drums of different forms, such as to give the best results in the equalization of moment on the engine. He then calculates and designs the gallows frame and shaft house, also other features such as ore bin, mine cage, car or skip.

Senior Year, Mining Engineering Option: Six laboratory hours per week throughout the year.

Mining 12.

Mining Examination: Sampling of ore bodies, estimation of "ore in sight" and valuation of mining properties; forms of report.

Administration: Business management and the principles of employment of labor; organization of mine staff.

Mine Accounting: Organization of corporations and stock companies, with particular reference to

mining and metallurgical companies; discussion of systems of mine and mill accounting; keeping accounts with different departments; derivation of cost sheets, etc., accounts of smelting and milling plants, yard books, furnace records, or books, smelting records, etc. General methods of business; buying and selling ores; labor, etc.; organization of the staff of a mining and metallurgical company.

Hygienic Conditions: Surface arrangements for the comfort and convenience of men; ascent and descent by ladders, cage and man engine, and relative economy of different methods; accidents, their causes and prevention; rescue and relief of men; mine fires.

Senior Year, Second Semester: Two lecture periods per week.

MATHEMATICS.

Professor McLaury.

The engineer, from the very nature of his work, must of necessity meet many difficult problems. His success will depend on his ability to solve them. As it is impossible to tell in advance just what experience a given student will meet, that course is best which results in mental power. It is not a question of what the student has done, but what he can do. Has he a comprehensive grasp of the subject; has he thoroughly mastered the principles; can he apply these principles to kindred subjects?

The aim of this department will be to give the student a thorough knowledge of the principles of mathematics so as to enable him to apply them readily to the solution of practical problems. Original work is encouraged, and an effort is made to cultivate the habit of exact, logical reasoning, and to stimulate independent thought. Both rapidity and accuracy are expected in all mathematical work. The great importance of mathematics as the basis of a scientific education justifies the requirement of all elementary courses, as a prerequisite to the engineering courses.

In the following courses, particular pains will be taken to explain all the more difficult algebraic processes as they occur. Several subjects in higher algebra will be discussed, each at the point where it is required for immediate application. Students who have not studied algebra for a year or more, should make a careful review before entering school, for a thorough knowledge of the elements of algebra is essential to the successful completion of all subsequent courses. All students who have had less than two years of algebra should take algebra with their Freshman work.

Classes will be provided for students who are deficient in algebra or solid geometry.

Mathematics 7.

Trigonometry: Plane, analytical and spherical. Considerable attention is paid to the consistent and

scientific development of the fundamental conventions and definitions, and to the derivation and transformation of trigonometric expressions. Many practical problems are solved.

Freshman Year, First Semester: Five lecture periods per week for sixteen weeks.

Text Book: Phillips & Strong's Trigonometry.

Mathematics 8.

Analytic Geometry: This course includes the following subjects: Loci, straight lines, transformation of co-ordinates; circles; conic sections; the general equation of the second degree and higher plane curves.

The theory will be developed by lectures.

Freshman Year, Second Semester: Five lecture periods per week for eighteen weeks.

Text Book: Nichol's Analytic Geometry.

Mathematics 9.

Differential Calculus: The text book work is supplemented by lectures. This course will include a short course in solid analytic geometry, based on Nichol's Analytic Geometry.

Sophomore Year, First Semester: Five lecture periods per week.

Text Book: Granville, Differential and Integral Calculus.

Mathematics 10.

Differential and Integral Calculus: This course is a continuation of the last course and will include the most of the work in Granville's Calculus.

Sophomore Year, Second Semester: Five lecture periods per week.

Mathematics 11.

Differential Equations, Junior Year. First Semester, Electrical Engineering Course: Three lecture periods per week.

Text Book: Differential Equations by D. A. Murray.

ENGLISH.

Professor McLearie.

The aim of this department is to give the student a command of good idiomatic English and to aid him in the development of the art of expression. Special emphasis is laid upon the importance of good composition in technical work. Attention is called to the absolute necessity that every professional man should be able to express his thoughts with clearness and accuracy.

English 9.

The Elements of Effective Writing: This course gives both theoretical and practical instruction. The theory is taught by class room work based on standard text books. The practice is obtained by exercises, written in the class room, and by weekly themes. At least one theme a week is required and every theme is returned to the student to be revised or rewritten.

Freshman Year, First Semester: Four lecture periods per week.

Text Books: Canby's English Composition; Berkeley's College Course in Writing from Models; Steeves and Ristine's Representative Essays in Modern Thought.

English 10.

This course supplements the work of the first semester by giving further practice in narrative, expository and argumentative writing. A study is made of the works of such authors as will aid in practical composition work. Three themes are required, each containing from 800 to 1,000 words. There will be a conference on each theme.

Freshman Year, Second Semester: Four lecture periods per week.

*Sociology.

This course is introductory in character. It consists of lectures and required reading on the contents and methods of Sociology. The physical, biological and psychological aspects of social evolution

will be discussed. As far as possible a number of modern social problems will be considered.

Junior Year, First Semester: Three lecture periods per week.

Text Book: Blackmor and Gillin's Outline of Sociology.

***Economics.**

This course will give a brief survey of the principles of economics. It will also include discussions of the more important contemporary economic and social problems.

Junior Year, Second Semester: Three lecture periods per week.

Text Book: Ely's Outline of Economics.

*Many up-to-date reference books are available to students selecting this course.

MODERN LANGUAGES

Miss Robinson

This department is open to all students desiring to become acquainted with the scientific knowledge of a language as well as its literary culture. French and German have importance in the study of the sciences, and the rapidly developing trade relations with Central and South American countries have made an increasing demand for Spanish. Courses are offered for two or more years in each language.* A rapid and systematic study of the essentials of grammar is emphasized and special attention is given to acquiring facility in conversing. Optional courses in French and Spanish in addition to those here outlined are offered to technical and non-technical students, the nature of the work depending somewhat on the individuals electing such courses.

French 1-2.

Elementary French: This course is intended for those who begin French at the School of Mines. Its aim is to enable the student to read ordinary French with ease, to understand to some extent the language when spoken, and to form simple sentences, both oral and written.

Freshman Year, First and Second Semester. Five lecture periods per week.

Texts and Readings: Fraser and Squair's Grammar; Composition from Francois; Halevy, L'Abee' Constantin; Hugo, Les Miserables.

French 3-4.

Advanced Prose Composition: This course is conducted mainly in French. The work is based upon selected texts and drill is also given in the writing of French themes and letters.

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*Classes in German at the present time not being organized.

Sophomore Year, First and Second Semester. Five lecture periods per week.

Readings: Labiche and Martin, Le Voyage de M. Perrichon; Dumas, La Tulipe Noire.

Spanish 1-2.

Elementary Spanish: This course aims to give a knowledge of the essentials of Spanish grammar, the ability to read ordinary Spanish with ease, and some practice in conversation.

First and Second Semester. Five lecture periods per week.

Text and Readings: DeVitis, Spanish Grammar; Roessler and Remy; Geddes, Padre Isla's Lesage's Gil Blair.

Spanish 3-4.

Advanced Spanish: Grammar is reviewed by means of composition and conversation. Modern novels and plays are read. This course is a continuation of Spanish 1-2 but more advanced in character.

First and Second Semester. Five lecture periods per week.

Readings: Galdos, Marinaela; Hill, Spanish Short Stories.

BIOLOGY.

Associate Professor Talbot.

All courses in biology are cultural but groups of them give a broad foundation for scientific agriculture, forestry, sanitation, medicine and other biological professions. They are of particular service in preparing the student for certain of the geological studies given in the Engineering courses and are open to all students of college rank.

Biology 7.

General Biology: This is an introductory course consisting of lectures, conferences and laboratory work. Influence of environment, heredity, variation, structure, life activities, plant and animal organisms in relation to each other, et cetera, are some of the features of the work.

Three lecture periods and two laboratory hours per week for one semester.

Text Book: Sedgwick and Wilson, General Biology.

Biology 8-9.

General Botany: The aim of this course is to give the student a general summary of the functions structure and inter-relations of plants. The first semester is devoted to the lower plants, algae, moss forms, and ferns. In the second semester frequent field trips are taken for the study of seed plants. A number of our early native plants are identified.

First and Second Semester. Three lecture periods and two laboratory hours per week.

Text Book: Atkinson-College Botany.

Biology 10-11.

Zoology: In this course a detailed study of typical representative forms of the main groups is made. Much emphasis is placed upon progressive development, form, structure, activities, life history, heredity and ecology.

First and Second Semester: Three lecture periods and two laboratory hours per week.

Text Books: Hegner's College Zoology, Sigerfoos' Laboratory Manual.

Biology 12.

Physiology: Recitations with laboratory study of skeleton, manikin, anatomical models, prepared slides and dissection of domestic animals.

Four lecture periods per week for one semester.

Text Book: Martin's Human Body.

Biology 13.

Evolution: The aim of this course is to present to the student the processes of evolution as they are so far understood. Animals and plants serve as illustrative material. Some of the topics considered are species forming heredity, mutation, variation, degeneration, instinct and reason.

One Semester. Three lecture periods per week.

Text Book: Jordan and Kellog's, Evolution and Animal Life.

SHOP WORK.

Mr. Coursen.

The aim of this department is to give the student a theoretical knowledge in the class room of the use of tools, with a practical understanding and care of the mechanical equipment in a modern mill.

Shop Work 1-2.

Wood Work: The work in the wood shop aims to train the student in the use of wood-working tools and machinery and to familiarize him with the properties of the common woods. Each student is furnished an outfit of bench tools which he is taught to keep sharp and in good condition. The use of simple tools is first learned and this is followed by work on the turning lathe, universal woodworker, etc. The entire course is bent toward the elimination of awkwardness and to enable the student to command the best use of his hands.

Six laboratory hours per week throughout the year.

Shop Work 3-4.

Forge and Machine Shop Work: This course begins with simple exercises in upsetting, bending, twisting, punching and welding. The work gradually becomes more difficult, such as making eye-bolts, chains, and tongs. Tool-making is then begun by making screw-drivers, hammers and chisels, to be used later in the machine shop. Forging includes the care of blacksmith's fire and tools, the study of forging, tempering, welding, and case hardening. The instructor makes the student familiar with the best grade of steel to be used for any required purpose, and the correct shape and temper necessary for the best work in cutting iron, steel, brass, and stone. The machine shop work includes molding, casting, use of the oxy-acetylene welding apparatus, the operation of the drill press, lathe, shaper, buffer and hack saw. Practice work in the machine shop concludes this course.

Three laboratory hours per week throughout the year.

Shop Work 5-6.

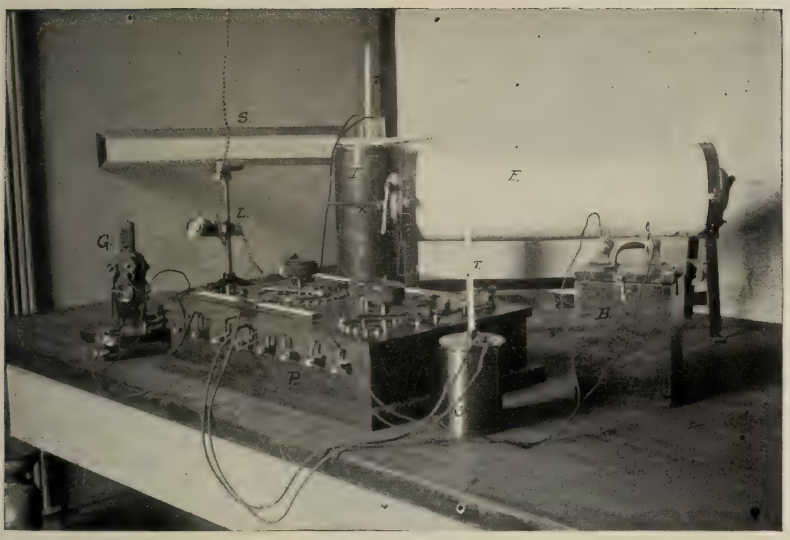
Pattern Making: The work in pattern making requires the construction of patterns for machines, or for parts of machines. Pattern making is studied in its relation to molding; the practical construction of patterns to prevent warping and distortion; the making of special patterns, cores and core boxes, introducing draft shrinkage, finish and the technical appliances and usages of modern pattern work.

Three laboratory hours per week throughout the year.

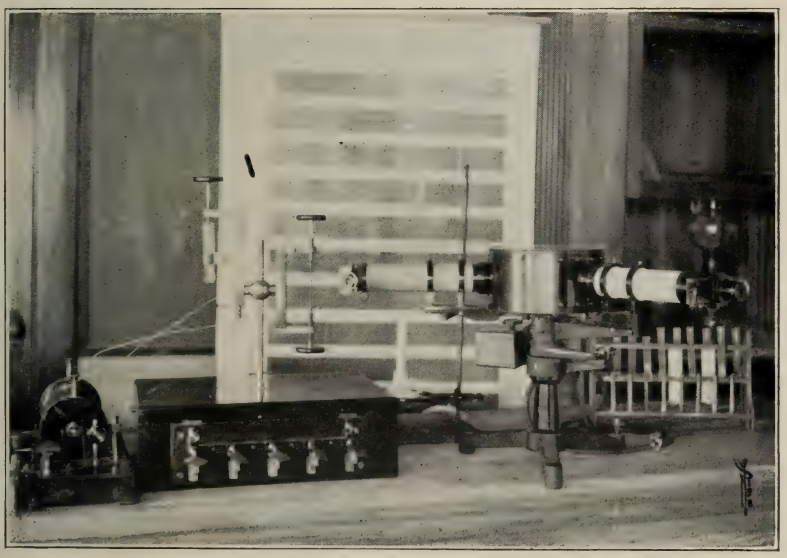
Shop Work 7-8.

Winding Laboratory: This course is designed to be of particular service to students taking the Electrical Engineering Course.

Junior Year: Three laboratory hours per week throughout the year.



Apparatus for Studying High Temperatures.



Spectroscope and Accessory Apparatus.

LIST OF STUDENTS, 1918-19.

Graduate Student

Newbowers, Frank J., B. S., '18.....Rapid City, S. D.

Senior Class

Hall, Ralph Julius .....Lead, S. D.
Mara, Hubert Wilbur .....Mellette, S. D.
Nelson, Harold Lee .....Rapid City, S. D.

Junior Class

Bentley, Charles .....Trojan, S. D.
Enos, George .....Cottonwood, S. D.
Gantz, Gardner .....Rapid City, S. D.
Mallman, Adolph .....Farmingdale, S. D.
Parsons, Merle .....Rapid City, S. D.
Schrader, Huston .....Rapid City, S. D.
Waldschmidt, William .....Lead, S. D.

Sophomore Class

Aikman, William .....Hermosa, S. D.
Bruce, Marion .....Wall, S. D.
Chapman, Leslie .....Terry, S. D.
Christensen, Harold .....Rapid City, S. D.
Cook, R. Lyle .....Kimball, S. D.
Gantz, Frank .....Rapid City, S. D.
Hammerquist, Charles .....Rapid City, S. D.
Hayes, Joel .....Rapid City, S. D.
Jacobs, Morris .....Lead, S. D.
Lintz, Mark .....Hermosa, S. D.
Norris, Paul .....Haydraw, S. D.
Perrigo, Harry .....Hermosa, S. D.
Platt, Charles .....Rapid City, S. D.
Wurtsbaugh, C. G. .....Irwin, Iowa

Freshman Class

Anderson, Payton .....Rapid City, S. D.
Anderson, Earl .....Sturgis, S. D.
Baughman, William .....Lebanon, Ind.
Brown, George D. .....Washington, Ind.
Calhoun, Paul .....Hot Springs, S. D.
Chase, Isaac H. .....Rapid City, S. D.
Connell, Wilbur .....Hot Springs, S. D.

Cox, William ..... Wasta, S. D.
Craven, Thomas L. ..... Belle Fourche, S. D.
Dickinson, Everitt ..... Underwood, S. D.
Elliott, Floyd ..... Oregon, Ill.
Elliott, Herbert ..... Rapid City, S. D.
Ferguson, Harry ..... Rapid City, S. D.
Gray, Alex ..... Rapid City, S. D.
Gray, George D. ..... Rapid City, S. D.
Gulliver, Hyrum D. ..... Reese, Mich.
Hansen, Eli ..... Rapid City, S. D.
Hawley, George E. ..... Rapid City, S. D.
Hett, Paul ..... Lead, S. D.
Hoffman, Edgar ..... Keystone, S. D.
Horgan, J. Emmett ..... Rapid City, S. D.
Hood, William Stanley ..... Waukesha, Wis.
Johnson, Arthur ..... Lead, S. D.
Johnson, George W. ..... Davenport, Iowa
Julius, John ..... Deadwood, S. D.
Kelley, Julius ..... Sturgis, S. D.
Kieffer, Ferdinand ..... Rapid City, S. D.
Kime, Charles R. ..... Hot Springs, S. D.
Lawrence, Thomas ..... Lead, S. D.
Lee, Harold ..... Rapid City, S. D.
McCracken, George ..... Hot Springs, S. D.
Manley, Louis ..... Sioux Falls, S. D.
Markvart, Edwin J. ..... Chicago, Ill.
Moore,, Ross E. ..... Aberdeen, S. D.
Newcomer, Delos ..... Rapid City, S. D.
Powers, Hubert ..... Rapid City, S. D.
Primrose, Shafter ..... Lead, S. D.
Robertson, Glen ..... Dupree, S. D.
Sinclair, Peter ..... Sturgis, S. D.
Smith, Carrol N. ..... Rapid City, S. D.
Smith, Delos ..... Beresford, S. D.
Stewart, Max Kent ..... Rapid City, S. D.

Special Student

Price, Samuel ..... Rapid City, S. D.

Preparatory Students

Brodsky, Frank ..... Owanka, S. D.
Dale, William ..... Rapid City, S. D.
Elrod, Simons Harold ..... Midland, S. D.
Haas, Maurice ..... Whitewood, S. D.
Hanson, Ralph ..... Whitewood, S. D.

Harmon, Ingwald ..... Draper, S. D.
Hearn, Miles ..... Rapid City, S. D.
Marsh, Corbin ..... Rapid City, S. D.
Marsh, Ralph ..... Rapid City, S. D.
Marsh, Frank ..... Rapid City, S. D.
Mulcahy, Edwin ..... Rapid City, S. D.
O'Harra, Paul ..... Rapid City, S. D.
Platte, Ralph ..... Rapid City, S. D.
Springer, Melvin ..... Philip, S. D.
Stark, Edward ..... Rapid City, S. D.
Westover, Maurice ..... Fairburn, S. D.
Westover, John ..... Fairburn, S. D.
Wilson, Elmer ..... Rapid City, S. D.

STUDENTS ARMY TRAINING CORPS
United States Army Training Detachments

VOCATIONAL SECTION I

1 Albertson, Castar, Montrose, S. D.....Mining
2 Aldworth, John Wert, Ideal, S. D.....Radio
3 Anderson, Alfred, Redfield, S. D.....Radio
4 Anderson, Otto Leon, Rapid City, S. D.....Radio
5 Andison, Arthur Daniel, Gann Valley, S. D...Mining
6 Armstrong, Jr., William Henry, Howard, S. D., Radio
7 Babcock, Manuel Earl, Aldershot, S. D.....Mining
8 Backous, Floyd Sanford, Wetonka, S. D.....Mining
9 Bainbridge, Thomas Homer, Canton, S. D.....Radio
10 Barada, Jobe, Geddes, S. D. .....Radio
11 Beckman, Carl Albert, Terraville, S. D.....Radio
12 Benson, Elvin Raymond, Fulton, S. D.....Mining
13 Bentley, Marvin James, Deadwood, S. D.....Radio
14 Betts, Claude William, Mitchell, S. D.....Mining
15 Black, James Alexander, Yankton, S. D.....Mining
16 Bogenhagen, Lewis Casper, White Lake, S. D., Mining
17 Bohl, John, Deadwood, S. D.....Radio
18 Boyer, Ernest William, Hill City, S. D.....Mining
19 Bremer, Alfred George, Chalk Butte, S. D...Mining
20 Bringelson, George Peter, Armour, S. D.....Mining
21 Chase, Lyle Richard, Ashton, S. D.....Radio
22 Clark, Arlene V., Big Stone City, S. D.....Radio
23 Clark, Augustus Dwight, Ipswich, S. D.....Mining
24 Clarke, Henry Ziba, Hermosa, S. D.....Mining
25 Closson, Calvin Earl, White Lake, S. D.....Mining
26 Cole, Bartholomew Matthias, Tyndall, S. D...Radio
27 Collins, Joseph Patrick, Chamberlain, S. D....Radio
28 Conner, Collins L., Weta, S. D.....Radio
29 Cook, Robert Septimus, Alpena, S. D.....Radio
30 Cornwell, Elbert Sylvester, Canistota, S. D....Radio
31 Crandall, Howard E.,Fairfax, S. D.....Mining
32 Croghan, William Patrick, Deadwood, S. D.....Radio
33 De Geest, Edward Cornelius, Box Elder, S. D., Mining
34 De Greef, Leo Philip, Philip, S. D.....Mining
35 Dobbin, Gerald Bingham, Iona, S. D.....Mining
36 Doughty, Hugh N., Wessington Springs, S. D., Mining
37 Durr, Frank Charles, Belle Fourche, S. D....Mining

38 Ewing, Harold S., Witten, S. D.....Radio
39 Falk, Harry Reuben Emanuel, Stratford, S. D..Radio
40 Fisk, Jarvis Wintle, Lily, S. D.....Mining
41 Fredrickson, Oscar Adolph, Loyalton, S. D....Radio
42 Fretts, Ambrose Leroy, Lakeville, Minn.....Radio
43 Gardner, Pete Filmore, Sioux Falls, S. D.....Radio
44 Gordon, Jr., Robert John, Yankton, S. D.....Radio
45 Grandy, Owen Broom, Waubay, S. D.....Mining
46 Grange, John, Flandreau, S. D.....Mining
47 Greiser, Fred Otto, Eureka, S. D.....Mining
48 Hall, Robert Llewellyn, Lead, S. D.....Radio
49 Hancock, Thomas John, Lead, S. D.....Mining
50 Hanneman, George Carl, Mitchell, S. D.....Radio
51 Harter, Gottlieb Henry, Armour, S. D.....Mining
52 Hawkins, Walter John, Watauga, S. D.....Radio
53 Hay, Arthur Emerson, Reville, S. D.....Radio
54 Herrboldt, Edwin Jacob, Hosmer, S. D.....Radio
55 James, Orion Lyneus, Yankton, S. D.....Mining
56 Jones, Uri Richard, Ipswich, S. D.....Mining
57 Jurgensen, Arthur, Watertown, S. D.....Radio
58 Kapsen, Homer Marten, Sioux Falls, S. D.....Radio
59 Kaye, Albert Arnott, Highmore, S. D.....Radio
60 Kolda, Frank Benjamin, Lesterville, S. D....Mining
61 Kratz, Carl Samuel, Mitchell, S. D.....Mining
62 Kregen, Fred Edward, Clear Lake, S. D.....Radio
63 Kruse, John William, Spencer, S. D.....Mining
64 Lapham, Homer Walton, Andover, S. D.....Radio
65 Leischner, Solomon D., Parkston, S. D.....Mining
66 Lewis, Gail M., Wall, S. D.....Radio
67 Lile, Hubert Dell, Leola, S. D.....Mining
68 Luedemann, Henry, Flandreau, S. D.....Radio
69 Mabbott, Wilder Jacob, Fruitdale, S. D.....Radio
70 Mallon, Joseph Francis, Custer, S. D.....Mining
71 Maxwell, Lewis Philo, Cresbard, S. D.....Mining
72 McCoy, George, Rapid City, S. D.....Radio
73 McFadden, Edward Patrick, Joliet, Ill. .....Radio
74 McNeary, Stephen Francis, Aberdeen, S. D...Mining
75 Miles, Arthur Edgar, Yankton, S. D.....Radio
76 Moore, Charlie Clifford, Alexandria, S. D.....Radio
77 Morford, Leland, Denver, Colo.....Radio
78 Morgan, Matthew, Ipswich, S. D.....Radio
79 Moyle, Edwin, Westport, S. D.....Mining
80 Mullin, Michael Bryan, Letcher, S. D.....Mining
81 Nelson, David, Dell Rapids, S. D.....Mining

82 Nelson, Knute N., Odlham, S. D. .....Mining
83 Newell, Franklin Robert, Cresbard, S. D.....Mining
84 Nickisch, Nathaniel, Bowdle, S. D.....Radio
85 Olson, Robert Barnit, Veblen, S. D.....Mining
86 Olstad, Einer Eliason, Madison, S. D.....Radio
87 Patton, Edwin William, Sioux Falls, S. D.....Radio
88 Peterson, Norman Augustus, Fedora, S. D.....Radio
89 Platt, Edward Hugh, Rapid City, S. D.....Mining
90 Potthast, Carl Raymond, Fairfax, S. D.....Radio
91 Redfern, William Harrison, Cody, Neb.....Mining
92 Redlin, Charles Herman, Summit, S. D.....Radio
93 Redlinger, George Abraham, Vienna, S. D....Mining
94 Roach, Thomas Henry, Rockham, S. D.....Mining
95 Roberts, Lilburn B., Philip, S. D.....Radio
96 Rossow, Alfred Carl, Herreid, S. D.....Radio
97 Sainsbury, John Forrest, Lamoille, Minn.....Radio
98 Sanborn, Delmar Cleveland, Beebe, S. D.....Radio
99 Schaible, Jacob Christian, Hosmer, S. D.....Radio
100 Schekel, George Joseph, Lake Andes, S. D.....Mining
101 Schneller, Oscar Abraham, Aberdeen, S. D...Mining
102 Scott, Bernon Leroy, Presho, S. D.....Mining
103 Severance, Leon Caldwell, Faulkton, S. D.....Radio
104 Shade, Harry Burr, Alexandria, S. D.....Mining
105 Smith, Ralph Wilbert, Henry S. D.....Mining
106 Smith, Roger Lee, Isabel, S. D.....Radio
107 Smythe, Frederic Marc, Elk Point, S. D.....Mining
108 Sorenson, Alfred, Gustave, S. D.....Radio
109 Spencer, Elmer Leslie, Nisland, S. D.....Radio
110 Strain, Joseph Francis, Armour, S. D.....Mining
111 Sutton, William John, Harrisburg, S. D.....Mining
112 Tschappat, Benjamin, Flandreau, S. D.....Mining
113 Tysdal, William Gilbert, Artesian, S. D.....Radio
114 Van Benthuysen, Harry Hill, Mitchell, S. D...Radio
115 Visser, Leonard, Hurley, S. D. .....Mining
116 Warnemunde, Thomas Emmett.....
Timber Lake, S. D.....Mining
117 Wassenaar, Sietse Poppe, Winfred, S. D.....Mining
118 Werckman, Edward Oliver, Pierre, S. D.....Radio
119 Winstead, Palmore, Taylor, Wessington Springs
..... Mining
120 Woldt, Harold Henry, Rutland, S. D.....Mining
121 Wortman, George Roy, Rapid City, S. D.....Radio
122 Wudel, Edward David, Parkston, S. D.....Mining
123 Zahalka, Jacob Leo, Ipswich, S. D.....Mining

VOCATIONAL SECTION II

1 Alexander, Claude Wells, Menno, S. D.....Radio
2 Areman, Edwin Otis, Huron, S. D.....Radio
3 Bailey, Ray, Carter, S. D.....Mining
4 Benda, Harry Fred, Iona, S. D.....Mining
5 Berg, David Leondard, Stockholm, S. D.....Radio
6 Beyer, William Paul, Chester, S. D.....Radio
7 Bierschbach, William John, Webster, S. D., Gas Engne
8 Billingham, Harry Elmer, Alexandria, S. D...Mining
9 Borne, Rudolph Julius, Watertown, S. D.....Mining
10 Bothwell, Clifford Dale, Miller, S. D.....Mining
11 Breeding, Paul, White Lake, S. D.....Radio
12 Brown, Earl Roosevelt, Van Meter, S. D.....Mining
13 Brown, Wellington Gore, Rapid City, S. D....Radio
14 Bucklin, Clarence Edward, Selby, S. D.....Mining
15 Bye, Floyd Marvin, Gayville, S. D.....Radio
16 Cassady, Wiley J., Miller, S. D.....Mining
17 Casper, Helmer Egedie, Lake Preston, S. D...Radio
18 Casper, Levi Selmer, Lake Preston, S. D.....Radio
19 Costello, Albert LeRoy, Lake Andes, S. D....Mining
20 Crawford, Andrew Henry, Huron, S. D.....Radio
21 Curington, Albert Russell, Meadow, S. D.....Mining
22 Dell, George Wallace, Aberdeen, S. D.....Radio
23 Dragseth, Martin Julius, Mitchell, S. D.....Radio
24 Dunn, Joseph, Harding, S. D.....Radio
25 Dyball, Howard Leslie, Estelline, S. D.....Radio
26 Fields, Charles Henry, Davis, S. D.....Radio
27 Foss, Paul Farnham, Buffalo Gap, S. D.....Mining
28 Gano, Richard Watson, Spearfish, S. D.....Radio
29 Gedstad, Bennie Alexander, Lennox, S. D., Auto Mech.
30 Gedstad, Eddie Melvin, Lennox, S. D....Auto Mech.
31 Griesel, Paul Kaphart, Philip, S. D.....Radio
32 Guhin, George Joseph, Aberdeen, S. D.....Radio
33 Hall, Daniel, Gann Valley, S. D.....Mining
34 Hammer, Herman Cady, Mitchell, S. D.....Mining
35 Hammer, Earl, Sioux City, Ia.....Radio
36 Hanson, Albert Oliver, Elk Point, S. D.....Mining
37 Hanson, Otto Andrew, Highmore, S. D.....Radio
38 Hawkinson, Gotfred Emanuel, Webster, S. D., Mining
39 Henzlik, Frank, Woonsocket, S. D.....Radio
40 Hensley, Frank Edwin, Wessington Springs..Mining
41 Hertz, Lapolt Henry, Fairfax, S. D.....Auto Mech.
42 Higgins, Maurice D., Rapid City, S. D.....Mining
43 Hilkemeier, Erwin Fred, Tulare, S. D.....Radio

44 Hines, William Daniel, Oral, S. D.....Radio
45 Hobart, Oscar Ernest Williams, Harrold, S. D., Radio
46 Horan, John Francis, Ideal, S. D.....Radio
47 Hoyt, J. N., Sturgis, S. D.....Mining
48 Janousek, Robert, Yankton, S. D.....Radio
49 Johnson, Alvid August Vijanis, Chicago, Ill..Mining
50 Jones, John Richard, Springfield, S. D.....Radio
51 Jost, Clarence Joseph, Presho, S. D.....Mining
52 Kamerer, Joseph Ferdinand, Rapid City, S. D., Mining
53 Kast, Ernest, Bushnell, S. D.....Radio
54 Kegan, Thomas Lafayette, La Crosse, Wis.....Radio
55 Kleven, Severin Gilbert, Sisseton, S. D.....Radio
56 Klingenberg, Jens Nickolas, Omaha, Neb.....Mining
57 Lawson, Wayne Javan, Crandall, S. D...Auto Mech.
58 Lawton, Chauncy Wenzlaff, Yankton, S. D.....Radio
59 Ledbetter, Joe, Reva, S. D.....Mining
60 Lupient, Isadore Adolph, Aberdeen, S. D., Gas Engine
61 Lynde, Noble Edwin, Howard, S. D.....Mining
62 McCrary, Henry H., Sturgis, S. D.....Radio
63 Marvin, Edward E., Sioux Falls, S. D.....Mining
64 Mascher, Edward Emery, White Lake, S. D...Mining
65 Menning, Clarence, Harrison, S. D.....Radio
66 Mercier, Joseph Herman, Elk Point, S. D.....Radio
67 Myers, Claude Leonard, Wentworth, S. D....Mining
68 Miller, Clifford Snoden, Chelsea, S. D.....Radio
69 Miller, Thomas William, Scotland, S. D...Carpenter
70 Moskness, Michael Antonie, Colman, S. D....Mining
71 Mooney, Lee Warren, Sioux Falls, S. D.....Mining
72 Moore, Harry Kimball, Whitney, S. D....Blacksmith
73 Mortensen, Melvin A., Gayville, S. D.....Mining
74 Murphy, Edward Lewis, Sisseton, S. D.....Mining
75 Nelson, Arthur Edward, Meckling, S. D...Blacksmith
76 Nelson, Charles Robert, Vermillion, S. D.....Radio
77 Nervig, Toralph Hilmar, Volin, S. D.....Radio
78 Neville, Joseph Harold, Redfield, S. D.....Radio
79 Nold, Leo Elorain, Tolstoy, S. D.....Mining
80 Palmer, William Albert, Mina, S. D.....Mining
81 Parr, Edgar Americus, Artesian, S. D.....Mining
82 Pillsbury, Grant, Waupum, Wis.....Radio
83 Place, Park Edward, Wessington, S. D.....Radio
84 Powell, Erwin Ray, Montrose, S. D.....Mining
85 Racek, Joseph, Prairie de Sac, Wis.....Radio
86 Richer, George W., Hot Springs, S. D.....Radio
87 Roehr, Walter Herman, Britton, S. D.....Mining

88 Rose, Charlie Wesley, Rockham, S. D.....Mining
89 Rose, John, Jr., Langford, S. D.....Mining
90 Rust, John, Sioux Falls, S. D.....Mining
91 Sallet, Herbert Hans, Trail City, S. D.....Mining
92 Schubert, Walter Atlee, Academy, S. D.....Radio
93 Semre, Edward .....Mining
94 Senn, Edward Louis, Jr., Deadwood, S. D.....Mining
95 Sever, Glen David, Lantray, S. D.....Mining
96 Shadewald, Forest Richard, Toronto, S. D.....Radio
97 Sharf, Carl, Summitt, S. D. .....Mining
98 Sloan, George Joseph, Sioux Falls, S. D.....Radio
99 Sloan, William Adolph, Vivian, S. D.....Radio
100 Smith, Frank Garfield, Leola, S. D.....Mining
101 Spunaugle, Samuel LeRoy, Shenandoah, Ia...Mining
102 Sorenson, John Mark, Webster, S. D.....Mining
103 Small, Robert Henry, Ashton, S. D.....Radio
104 Seinbach, Emil Avid, Lead, S. D.....Radio
105 Stevens, Francis Winfred, Kaylor, S. D.....Radio
106 Straight, Harry Irvin, Bradley, S. D.....Radio
107 Teutsch, Wesley John, Colome, S. D.....Radio
108 Tronson, Fred Thomas.....Radio
109 Turgeon, Dolar Louie, Bijou Hills, S. D.....Mining
110 Turner, Leslie Elmor, Leola, S. D.....Radio
111 Uzel, Max, Oldham, S. D.....Mining
112 Vojta, Frank, Mound City, S. D.....Radio
113 Waggoner, Roy Arthur, Bonesteel, S. D.....Radio
114 Waters, Leo VanCourt .....Radio
115 Watts, William Francis, Watertown, S. D.....Radio
116 Waltner, Edwin Rudolph, Freeman, S. D.....Radio
117 Webber, William, Chamberlain, S. D.....Mining
118 Wendelken, Harry Roy, Elkton, S. D.....Radio
119 Wenz, Walter Wallace, Aberdeen, S. D...Blacksmith
120 Werner, Frank Walter, Salem, S. D.....Radio
121 Westgard, Julius, Astoria, S. D.....Mining
122 Wiesner, Louie Carl Fredrick.....
Clear Lake, S. D. .....Radio
123 Williams, Walter, Madison, S. D.....Radio

COLLEGIATE SECTION*

1 Anderson, Payton, Rapid City, S. D.....Engineering
2 Aikman, William, Hermosa, S. D.....Engineering
3 Baughman, William D., Lebanon, Ind...Engineering
4 Brown, George D., Washington, Ind.....Engineering
5 Bruce, Marion, Wall, S. D.....Engineering

6 Calhoun, Paul, Hot Springs, S. D.....Engineering
7 Craven, Thomas L., Belle Fourche, S. D., Engineering
8 Cox, William, Wasta, S. D.....Engineering
9 Chapman, Leslie, Terry, S. D.....Engineering
10 Christensen, Harold, Fairbault, Minn....Engineering
11 Connell, Wilbur, Hot Springs, S. D.....Engineering
12 Cook, R. Lyle, Kimball, S. D.....Engineering
13 Chase, Isaac H., Rapid City, S. D.....Engineering
14 Dickenson, Everett .....
New Underwood, S. D.....Engineering
15 Enos, George, Cottonwood, S. D.....Engineering
16 Elliott, Floyd H., Oregon, Ill.....Engineering
17 Elliott, Herbert, Rapid City, S. D.....Engineering
18 Ferguson, Harry, Rapid City, S. D.....Engineering
19 Gray, Alex, Rapid City, S. D.....Engineering
20 Gray, George D., Rapid City, S. D.....Engineering
21 Gulliver, Hyrum D., Reese Mich.....Engineering
22 Hett, Paul, Lead, S. D.....Engineering
23 Horgan, Emmett, Rapid City, S. D.....Engineering
24 Hansen, Eli, Rapid City, S. D.....Engineering
25 Hood, Stanley, Waukesha, Wis.....Engineering
26 Hall, R. Julius, Lead, S. D.....Engineering
27 Hawley, George E., Rapid City, S. D.....Engineering
28 Hayes, Joel, Rapid City, S. D.....Engineering
29 Hoffman, Edgar, Keystone, S. D.....Engineering
30 Hammerquist, Chas., Rapid City, S. D...Engineering
31 Johnson, Arthur, Lead, S. D.....Engineering
32 Johnson, George, Davenport, Iowa.....Engineering
33 Julius, John, Spearfish, S. D.....Engineering
34 Jacobs, Morris, Lead, S. D.....Engineering
35 Kime, Chas. R., Hot Springs, S. D.....Engineering
36 Kieffer, F. M., Rapid City, S. D.....Engineering
37 Kelley, Julius, Sturgis, S. D.....Engineering
38 Lawrence, Thomas, Lead, S. D.....Engineering
39 Lee, Harold G., Rapid City, S. D.....Engineering
40 Lintz, Mark, Hermosa, S. D.....Engineering
41 McCracken, George, Hot Springs, S. D...Engineering
42 Mara, Herbert, Mellette, S. D.....Engineering
43 Mallman, Adolph, Farmingdale, S. D....Engineering
44 Manley, Louis, Sioux Falls, S. D.....Engineering
45 Markvart, E. J., Chicago, Ill.....Engineering
46 Newcomer, Delos, Rapid City, S. D.....Engineering
47 Nelson, Harold G., Rapid City, S. D.....Engineering
48 Primrose, Shafter, Lead, S. D.....Engineering

49 Powers, Hubert, Rapid City, S. D.....Engineering
50 Parsons, Merle, Rapid City, S. D.....Engineering
51 Platt, Chas., Rapid City, S. D.....Engineering
52 Robertson, Glenn, Dupree, S. D.....Engineering
53 Smith, Delos, Beresford, S. D.....Engineering
54 Carroll, Rapid City, S. D.....Engineering
55 Sinclair, Peter, Sturgis, S. D.....Engineering
56 Stewart, Max Kent, Rapid City, S. D....Engineering
57 Schrader, Huston, Rapid City, S. D.....Engineering
58 Waldschmidt, William, Lead, S. D.....Engineering
59 Wurtsbaugh, C. G., Irwin, Iowa.....Engineering

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*Many of the students named here are listed also under the class subdivisions elsewhere, they having continued their studies in the institution after demobiliaztion.

ALUMNI

ALDER, ALFRED, JR., B. S., in Metallurgical Engineering, 1913; in military service (Engineering corps). Formally Metallurgical Chemist, Buenos Ayres, Argentina.

ALGER, OTILLE BEHRENS, B. C., Custer, S. D.

ANDERSON, AMIL ABNER, B. S. in Metallurgical Engineering, 1913; Met. E. 1917; in military service; formerly Superintendent Elkhorn Tungsten Co., Hill City, S. D.

ANDERSON, FRANK, B. S. in Mining Engineering, 1917; Mining Geologist, Mina Serafina, Bayanio, Oriente, Cuba.

ANDERSON, WILLIAM L., B. S. in Metallurgical Engineering, 1911; Met. E., 1914; Metallurgical Engineer, Rochester, Nevada.

ANDERSON, O. ALLEN, B. S. in Mining Engineering, 1904; E. M., 1907. Superintendent August Mining Co., Landusky, Montana.

ARENTZ, SAMUEL S., B. S. in Mining Engineering, 1904; E. M., 1906. In military service. Formerly Mining Engineer, Salt Lake City, Utah.

BENNETT, RICHARD T., B. S. in Mining Engineering, 1910; in military service. Formerly Electrician, Minneapolis, Minnesota.

BETTERTSON, JESSE O., B. S. in Metallurgical Engineering, 1909; Met. E., 1912. Chemist, American Smelting and Refining Co., Omaha, Nebraska.

BOCHERT, WILLIAM C., B. S. in Mining Engineering, 1914; E. M., 1917. Professor of Mining, South Dakota School of Mines, Rapid City, S. D.

BOOTH, LIONEL E., B. S. in Metallurgical Engineering, 1915; in military service. Formerly in Testing Laboratory of Anaconda Copper Co., Anaconda, Montana.

BROOKS, FLOYD, B. S. in Metallurgical Engineering, 1911. Assisant Mines Superintendent, Black Lake Asbestos and Chrome Co., Limited.

BRYANT, FRANK, B. S. in Mining Engineering, 1907; E. M., 1911. Mine Foreman, Kendall Leasing Co., Kendall, Montana.

CLARK, EDWIN, B. S. in Mining Engineering, 1918; Insructor in Physcis, South Dakota School of Mines, Rapid City, S. D.

CLEVENGER, G. HOWELL, B. S. in Mining Engineering, 1901; E. M., 1908; A. M., Columbia University.

COOLIDGE, EDWIN, B. S. in Mining Engineering, 1906; E. M., 1911. General Manager, St. Paul-Montana Mining Co., Maiden, Montana.

COOLIDGE, EDWIN, B. S. in Mining Engineering, 1906; E. M., 1912. In military service (Engineering corps). Formerly Mining Engineer, Tyrone, New Mexico.

COOLIDGE, ROY R., B. S. in Mining Engineering, 1909; E. M., 1911. Died, January 7, 1919.

CRAGIN, RODNEY, B. S. in Metallurgical Engineering, 1916. In military service. Formerly with the American Tin and Tungsten Co., Hill City, S. D.

CORNELL, WHARTON, B. S. in Mining Engineering, 1907. 1711 Rodney Street, Wilmington, Del.

CREMER, FRANK, B. S. in Mining Engineering, 1917. Engineer, Parkston, S. D.

CURRAN, HARRY T., B. S. in Mining Engineering, 1906; E. M., 1908. Mining and Metallurgical Engineer, W. L. Shaffer & Co., Idaho Springs, Colo.

DAWES, EVA ROBINSON, B. S., A. M. Formerly Professor of Home Economics, University of South Dakota, Vermillion, S. D.

DENNIS, PAUL, B. S. in Metallurgical Engineering, 1916. In military service. Formerly with the Socorro Mining Co., Mogoleon, New Mexico.

DEUTSCH, HARRY, B. S. in Metallurgical Engineering, 1918. Metallurgical Engineer, Aluminum Castings Co., 2249 Belfield Ave., Cleveland, Ohio.

DICKEY, SAMUEL C., B. S. in Mining Engineering, 1912. Mining Engineer, Elkhorn Tungsten Co., Hill City, S. D.

EDDY, JOHN, B. S. in Mining Engineering, 1910. Helena, Mont.

EHLE, CHESTER G., B. S. in Mining Engineering, 1911. Water Engineer, City Hall, Portland, Oregon.

ELDRIDGE, ROBERT, B. S. in Metallurgical Engineering, 1914.

ELLERMAN, OTTO, B. S. in Mining Engineering, 1907; E. M., 1911. State Mine Inspector, Lead, S. D.

ELLIOTT, JOHN WING, B. S. in Mining Engineering, 1910. Manager, Columbus Auto Co., Columbus, Nebraska.

FAHRENWALD, FRANK A., B. S. in Mining Engineering, 1912; E. M., 1914, South Dakota School of Mines; M. S., Pennsylvania State College; Ph. D., University of Michigan. Consulting Metallurgist, 1692 Glenmount Roard, Cleveland, Ohio.

FAHRENWALD, ARTHUR W., B. S. in Metallurgical Engineering, 1914. Met. E., 1916.

FARNHAM, LLOYD L., B. S. in Mining Engineering, 1914. Oil Geologist, Thermopolis, Wyo.

FEIGEL, CARRIE, B. S. Deputy Clerk of Courts, Rapid City, S. D.

FLEICHMAN, LEO., B. S. in Mining Engineering, 1914. Mine Superintendent, Rowena, Colorado.

FLOWER, GEORGE EARL, B. S. in Metallurgical Engineering, 1910. Superintendent, Cleveland Filtration Plant, Cleveland, Ohio. Address, 1542 Olivewood, Lakewood, Ohio.

GAINS, WILLIAM, B. S. in Mining Engineering, 1906. Superintendent, Montana Mines and Metal Co., Norris, Montana.

GATES, CLYDE, B. S. in Mining Engineering, 1915. Teacher, Rapid City High School, Rapid City, S. D.

GOODNER, IVAN E., B. S. in Metallurgical Engineering, 1908. Engineer, Columbia Basin Irrigation Project, Spokane, Washington.

HALL, ARTHUR E., B. S. in Mining Engineering, 1904; Met. E., 1906. Superintendent, American Smelting and Refining Co., Omaha, Nebraska.

HALL, RALPH JULIUS, B. S. in Metallurgical Engineering, 1919. Foreman, United Gold Mines Co., Granite, Oregon.

HALLEY, JAMES, JR., B. S. in Mining Engineering, 1905. Cashier Keystone Bank, Keystone, S. D.

HANCHER, JOHN W., B. S., M. S., South Dakota School of Mines; A. M., Mount Union College; LL.D., Simpson College. Associate Secretary of the Board of Education of the Methodist Episcopal Church, 150 Fifth Avenue, New York City.

HARTGERING, J. M., B. S. in Metallurgical Engineering, 1913. With Clarence W. Hubble, Consulting Engineer, Detroit, Michigan.

HEBBLETHWAITE, L. L., B. S. in Mining Engineering, 1908. Evanston, Ill.

HENTON, HUGH M., B. S. in Metallurgical Engineering,

1913. Instructor in Metallurgy, Case School of Applied Science, Cleveland, Ohio.

HILL, ROBERT S., B. S. in Mining Engineering, 1914. Diamond Prospector, care Forminiere Mission, Kasai, Tshikapa, Congo, Belge, via Boma and Luebo.

HILL, JOSEPH H., B. S. in Mining Engineering, 1916. Diamond Prospector, care Forminiere Mission, Kasai, Tshikapa, Congo, Belge, via Boma and Luebo.

HOPKINS, MAX, B. S. in Mining Engineering, 1901. Vice President and Sales Manager, Electra-Texas Oil Lands Co., Milwaukee, Wis.

HVISTENDAHL, ELI A., A. B., University of South Dakota; B. S. in Mining Engineering, 1909. South Dakota State School of Mines. Chemist, American Smelting and Refining Co., Omaha, Nebraska.

IVES, GLEN P., B. S. in Mining Engineering, 1908; E. M., 1912. General Manager, Compani de Mines, Cachinal, Taltal, Chile.

JEFFRIES, ZAY, B. S. in Mining Engineering, 1910; Met. E., 1914. Aluminum Castings Co., Cleveland, Ohio.

JONES, H. W., A. B. University of South Dakota; B. S. in Mining Engineering, 1909, South Dakota School of Mines. Farmer, Rapid City, S. D.

LEDYARD, LEWIS, B. S. in Metallurgical Engineering, 1909. Mining Engineer, Teck-Hughes Gold Mines, Kirkland Lake, Ontario.

MARSHALL, WILLARD C., B. S. in Mining Engineering, 1909. Rapid City, S. D.

MARA, HUBERT WILBUR, B. S. in Metallurgical Engineering, 1919. Millman, United Gold Mines Co., Granite, Oregon.

MATSON, BERNARD, B. S. in Mining Engineering, 1907. Superintendent Refinery, United States Mint, Denver, Colorado.

McCAULEY, WILLARD J., B. S. in Mining Engineering, 1914. Mining Engineer, Ray, Arizona.

MEENTS, R. O., B. S. in Mining Engineering, 1914. Mining Engineer, Miami, Arizona.

MELLINGER, LLOYD, B. S. in Mining Engineering, 1907. Died December 26, 1918.

MORRIS, MILTON, B. S. in Mining Engineering, 1907. Assayer, Philipsburg, Montana. Care Bi-Met.

MOSIER, PETER, B. S. in Mining Engineering, 1912. Engineer, Inspiration Copper Co., Inspiration, Arizona.

MUHMEL, FRED J., B. S. in Mining Engineering, 1911. Scotland, S. D.

NELSON, HAROLD LEE, B. S. in Mining Engineering, 1919.

NEWBOWERS, FRANK J., B. S. in Mining Engineering, 1918. With Flynn & Co., Rapid City, S. D.

O'BRIEN, B. D., E. E. Rose Polytechnic, 1896; B. S. in Metallurgical Engineering, 1906; E. M., 1910, South Dakota School of Mines. Sundance, Wyoming.

O'HARRA, B. MARVEL, B. S. in Metallurgical Engineering, 1915. Superintendent, Bismuth Department, American Smelting and Refining Co., Omaha, Nebraska.

OSSA, IGNACIO DIAZ, B. S. in Metallurgical Engineering, 1908. President, School of Mines of Serena, La Serena, Chile.

OVERPECK, ARELI C., B. S. in Mining Engineering, 1902; E. M., 1906. Examining Engineer, Bureau of Mines, 334 West 53rd Street, Los Angeles, California.

OVERPECK, HOLLIS W., B. S. in Mining Engineering, 1905; E. M., 1907. Mine Superintendent, Oliver Iron Mining Co., Buhl, Minnesota.

OVERPECK, LEM S., B. S. in Mining Engineering, 1908. With Frazier and Johnson Commission Co., South Omaha, Nebraska.

PENHOEL, LOUIS, B. S. in Mining Engineering, 1906. Mining Engineer, Southwestern Engineering Co., 1221 Hollingsworth Bldg., Los Angeles, California.

POZNANSKY, BENJAMIN, B. S. Died December 12, 1918.

PRICE, VIRGIL T., B. S. in Metallurgical Engineering, 1917. Chemist, American Smelting and Refining Co., Omaha, Nebraska.

PRYER, W. CHRISTY, B. S. in Metallurgical Engineering, 1914. In Testing Laboratory, Anaconda Copper Co., Anaconda, Montana.

QUINNEY, ELWIN H., B. S. in Mining Engineering, 1911; Met. E., 1913. Engineer, State Highway Commission, Huron, S. D.

READ, J. BURNS, B. S. in Mining Engineering, 1906; E. M., 1908. Captain, Ordnance Department, United States Army, Washington, D. C.

READ, HERBERT, B. S. in Mining Engineering, 1909. E.

M., 1911. Assistant General Manager, Socorro Mining Co., Mogollon, New Mexico.

SARGENT, ARTHUR E., B. S. in Metallurgical Engineering, 1910. General Manager, Mogul Mine, Terry, S. D.

SAVILLE, JOSEPH H., B. S. in Metallurgical Engineering, 1910; E. M., 1912. Wilmington, Delaware.

SEITER, HERBERT, B. S. in Mining Engineering, 1906. Merchant, Albion, Nebraska.

SMITH, EARL VAN L., B. S. in Mining Engineering, 1906. Akron, Ohio.

SMITH, ELWYN, B. S. in Metallurgical Engineering, 1916. Research Assistant, Bureau of Mines, St. Paul, Minn.

SPARLING, W. G., B. S. in Mining Engineering, 1908. Rapid City, S. D.

STONER, JOHN WILLIAMS, B. S., in Mining Engineering, 1910. Mining Engineer, Judge Mining and Smelting Co., Park City, Utah.

STOUT, HERBERT, B. S. in Metallurgical Engineering, 1918. Mining Engineer, United States Gypsum Co., Fort Dodge, Iowa. Address 216 S 16th St., Fort Dodge, Iowa.

STOWELL, GEORGE E., B. S. in Mining Engineering, 1914. Assistant Mining Engineer, Bureau of Mines, 4335 12th Avenue, Seattle, Washington.

THIEL, ARTHUR, B. S. in Metallurgical Engineering, 1915. Engineer, Alexandria, S. D.

THOMPSON, C. C., B. S. in Mining Engineering, 1902; E. M., 1906. United States Deputy Mineral Surveyor for Nevada. Goldfield, Nev.

VAN NUYS, C. C., A. B., Yankton College; B. S. in Mining Engineering, 1907; E. M., 1910, South Dakota School of Mines; A. M., Columbia University. Address, Apartment 31, 559 W. 191 St., New York City.

WELLS, LEON PECK, B. S. in Mining Engineering, 1907.

WETHERALD, FREDERICK B., B. S. in Mining Engineering, 1906; Met. E., 1914. 39 Eldom Street, Dorchester, Mass. With Stone and Webster, Engineers, Boston, Mass.

West, Elmer W., B. S. in Mining Engineering, 1904; E. M., 1906. Chemist, 138 East Rose Street, Stockton, California.

WHEELOCK, HARRY ELLIS, B. S. in Mining Engineering, 1910. Mining Engineer, 85 Mining Co., Valedon, New Mexico.

WHITEMORE, CHARLES, B. S. in Mining Engineering, 1907. Hardware Merchant, Canton, S. D.

WHYTOCK, PETER, B. S. in Mining Engineering, 1906. Mining Engineer, Tonopah, Nevada.

WILLARD, CLARENCE G., B. S. in Metallurgical Engineering, 1911; Met. E., 1914. Metallurgist, Marcy Mill Department, Mine and Smelter Supply Co., Denver, Colorado.

WINTERS, FRED W., B. S. in Mining Engineering, 1908. E. M., 1911. Lake City, Minnesota.

WINSOR, FRANK H., B. S. in Metallurgical Engineering, 1911. Mitchell, S. D.

WOLCOTT, GUY E., B. S. in Mining Engineering, 1904. Mining Engineer, Cripple Creek, Colorado.

WONG, YU-CHIH, B. S. in Metallurgical Engineering, 1918. Chemist, American Smelting and Refining Company, Omaha, Nebraska.

WOODARD, D. C., B. S. in Mining Engineering, 1908. Assayer and Metallurgist, La Serena, Chile.

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South Dakota State School of Mines

Annual Catalog
1919-1920

With Announcements for 1920-1921

RAPID CITY, SOUTH DAKOTA
May, 1920

South Dakota State School of Mines

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1919-1920

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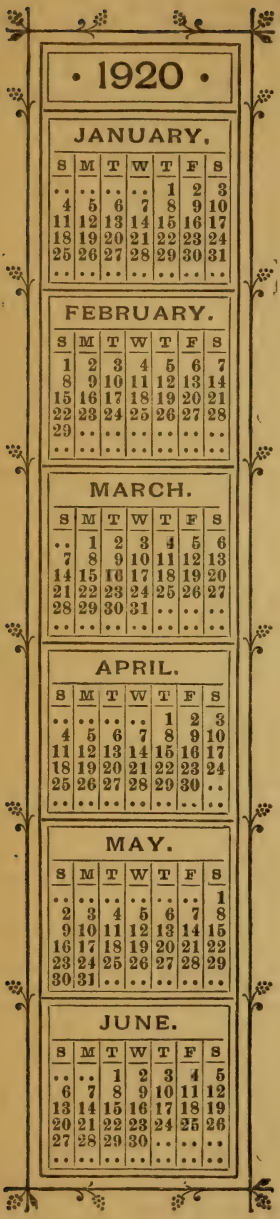
Hipple Printing Co., Pierre, S. D.



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JANUARY.

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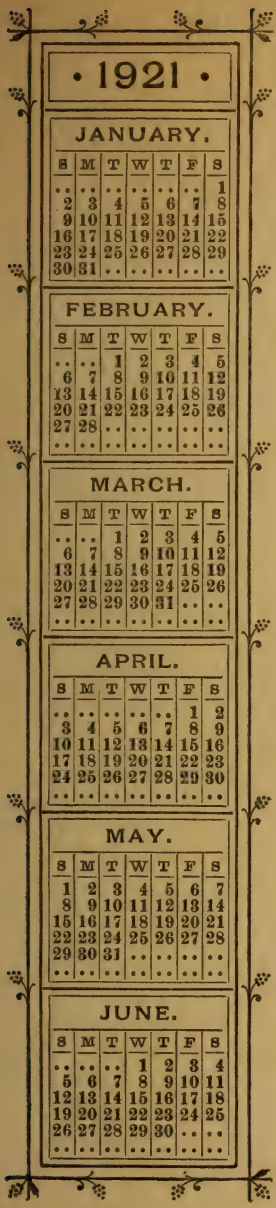

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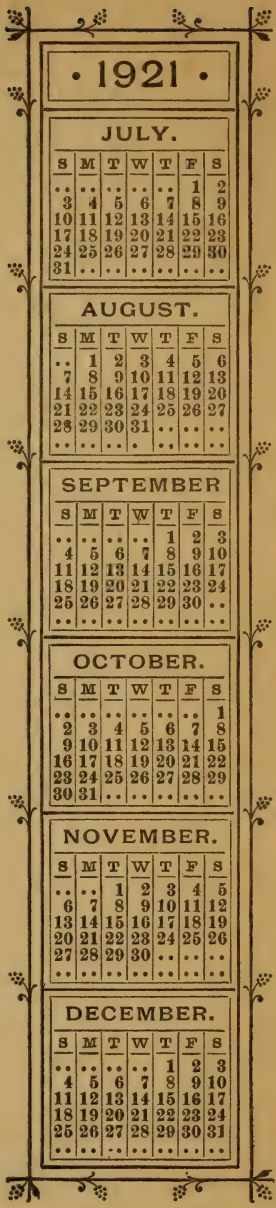

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JULY.

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OCTOBER.

S	M	T	W	T	F	S
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9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31	..	..	..	..	..

NOVEMBER.

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13	14	15	16	17	18	19
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DECEMBER.

S	M	T	W	T	F	S
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11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31
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COLLEGE CALENDAR

1920

Sept. 14, Tuesday.....Registration.
Sept. 15, Wednesday..... First Semester begins.
Nov. 25, Thursday..... Thanksgiving Recess begins.
Dec. 20, Monday ..... Christmas Vacation begins.

1921

Jan. 1, Saturday.....Christmas Vacation ends.
Jan. 24 to Jan. 29.....Midyear Examinations.
Jan. 29, Saturday..... First Semester ends.
Jan. 31, Monday..... Second Semester begins.
Feb. 22, Tuesday..... Washington's Birthday.
March 28 to April 2.....Annual Field Trips.
May 29, Sunday ..... Baccalaureate Sermon.
May 30, Monday.....Final Examinations begin.
June 2, Thursday.....Commencement and Conferring of Degrees.
June 3, Friday .....Final Examinations end.

REGENTS OF EDUCATION

Members of the Board.

THEODORE W. DWIGHT, Sioux Falls
Term expires January 1, 1921

AUGUST FRIEBERG, Beresford
Term expires January 1, 1925

FREDERICK A. SPAFFORD, Flandreau
Term expires January 1, 1925

J. W. CAMPBELL, Huron
Term expires January 1, 1921

Officers of the Board.

THEODORE W. DWIGHT, President, Sioux Falls.

IRWIN D. ALDRICH, Secretary, Big Stone.

G. H. HELGERSON (State Treasurer), Treasurer Ex-officio.

Regents Committee in Charge of the School of Mines.

FREDERICK A. SPAFFORD.

FACULTY OF THE SCHOOL OF MINES

CLEOPHAS CISNEY O'HARRA
President and Professor of Geology.
A. B., Carthage College; Ph. D., Johns Hopkins University.

HOWARD LINCOLN McLAURY
Professor of Mathematics.
A. B., Oberlin College; A. M., Harvard University.

JOHN McLEARIE
Professor of English.
A. B., Macalester College; A. M., University of Chicago.

WILLIAM CHARLES BOCHERT
Professor of Mining.
B. S., E. M., South Dakota State School of Mines.

CHARLES LEE SWISHER
Professor of Physics.
A. B., University of Illinois; A. M., University of Michigan; Ph. D., Cornell University.

FRANK WEISS TRAPHAGEN
Professor of Metallurgy.
Ph. D., Columbia University.

CHARLES STEWART BISSON
Professor of Chemistry.
B. S., M. S., Ph. D., University of California.

JOSEPH PETER CONNOLLY
Professor of Mineralogy and Petrography
A. B., Oberlin College; A. M., University of Missouri; A. M., Harvard University.

ARTHUR STAFFORD HATHAWAY
Professor of Civil Engineering.
B. S., Rose Polytechnic Institute.

BERNARD EMERSON LEETE
Associate Professor of Biology
B. A., M. F., Yale University.

AGNES L. ROBINSON
Instructor in Modern Languages and History.
A. B., University of Iowa; A. M., University of Wisconsin.

EDWIN CLARK*
Instructor in Physics.
B. S., South Dakota State School of Mines.

FRED GUSHURST
Director of Athletics.
LL. B., University of Notre Dame.

DELLA MAY HAFT
Librarian.
Ph. B., University of Chicago.

ANNA LEWIS
Registrar and Secretary to the President.

CHARLES BENTLEY, Analyst
In Charge of Mining Experiment Station Work.

JEAN McCORMICK
Stenographer.

GEORGE THOMSON
Superintendent of Buildings and Grounds.

Student Instructor in Mathematics

LUTHER M. WHITE

Student Laboratory Assistants

GEORGE ENOS, Chemistry
C. GUY WURTSBAUGH, Chemistry
GARDNER GANTZ, Metallurgy
WILLIAM WALDSCHMIDT, Geological Museum
WILLIAM AIKMAN, Civil Engineering
MERLE PARSONS, Civil Engineering
MORRIS JACOBS, Physics

*Mr. Clark resigned October, 1919. His classes were cared for by the following advanced students. Harold Christensen, Edwin J. Markvart, Huston Schrader, Raymond March.

STANDING COMMITTEES OF THE FACULTY

ADMISSION AND REGISTRATION

Charles L. Swisher — Charles S. Bisson
Howard L. McLaury — Joseph P. Connolly

EMERGENCIES

Howard L. McLaury — Charles S. Bisson
William C. Bochert — Frank W. Traphagen
Charles L. Swisher — John McLearie
Joseph P. Connolly

STUDENT SOCIAL COMMITTEE

William C. Bochert — Frank W. Traphagen
Agnes L. Robinson — Arthur S. Hathaway
Fred Gushurst

STUDENT ADVISORY

Joseph P. Connolly — William C. Bochert
Howard L. McLaury

THESES AND DEGREES

Frank W. Traphagen — Charles L. Swisher
Joseph P. Connolly

LIBRARY

Arthur S. Hathaway — Frank W. Traphagen
Della M. Haft — Bernard E. Leete

SCHOOL MAGAZINE

John McLearie — Arthur S. Hathaway
Charles S. Bisson

CATALOG

Charles S. Bisson — Agnes L. Robinson
William C. Bochert

BOARD OF CONTROL OF THE STUDENT ASSOCIATION

John McLearie — C. Guy Wurtsbaugh, '21
Cleophas C. O'Hara — Gardner Gantz, '20
William C. Bochert — Shafter Primrose, '22
Howard L. McLaury, Secretary of the Faculty

The President of the institution is ex-officio member of all faculty committees.

The regular meeting of the Faculty is held on the first Friday of each month at 3:45 P. M.

GENERAL STATEMENT

Establishment of the School

The School of Mines is a state educational institution, and is maintained almost wholly by appropriations made by the State Legislature. It is endowed with 40,000 acres of South Dakota land, a grant from the federal government. The income from the rental of these lands is steadily increasing. The school is under the direction of the Regents of Educaton. The regents, five in number, are appointed by the governor, confirmed by the senate and have control of the various public institutions of learning maintained wholly or in part, by the state as state institutions.

The following is an extract from the act of the Legislature, establishing the School of Mines:

Section 1. (School of Mines Established.) That a School of Mines for the Territory of Dakota be established at Rapid City, in Pennington County, Dakota Territory. It shall be the object of such School of Mines to furnish facilities for the education of such persons as may desire special instruction in Chemistry, Metallurgy, Mineralogy, Geology, Mining, Milling, Engineering, Mathematics, Mechanics, Drawing, the Fundamental Laws of the United States and the Rights and Duties of Citizens.

Approved March 7, 1885.

History and Aim of the School

The State School of Mines offers young men a thorough education in mining and metallurgical engineering, believing that thereby the exploitation of the mineral resources of the state will be aided. Whenever it is possible, the school also assists in the development of the mineral resources of the state by the investigation of mining and metallurgical problems which arise. At the present time many graduates of the school are employed in re-

sponsible positions in the Black Hills and throughout the West generally and the institution is doing much toward the development of the state's mineral wealth.

The school issues from time to time, bulletins treating of Black Hills geology, and of mining and metallurgical methods. A list of the bulletins is given on a subsequent page. They may be obtained upon request by those interested.

The first building of the school was erected in 1885. It is a three-story brick structure in which were originally, chemical and assay laboratories, and class rooms. The school, under able management, gained in reputation, and, in 1887, erected a second building to serve the purpose of a metallurgical laboratory. This building, is 138 feet by 60 feet in size, and fitted with metallurgical and mining experimental machinery. The front portion of what is now the Main Building of the school was erected in 1901 and two years later this was much enlarged by a rear addition. The central heating plant, provided in 1903, was enlarged in 1909 and important new equipment was added in 1911.

The legislature in recent session appropriated $100,000 for a new engineering building and materially increased the funds for the general running expenses of the institution.

Location

The School of Mines is located at Rapid City the gateway to the Black Hills of South Dakota. The Black Hills region is the gem of the central northwest. Perhaps no area of equal extent in America more fittingly represents a well-selected group of community interests. By geographic position, topographic configuration, natural resources and commercial facilities it is the controlling magnet of a great area for industry, trade and recreation.

Structurally, the region is an elliptical outwardly-dipping uplift, the more distinct features of which show a maximum extent of about 150 miles in length and 80 miles in width. The longer axis approximately coincides with the meridian except in the northern portion, where the general direction is to the northwest. Each rock unit, with its particular and sometimes striking color, yields distinctive topographic forms, the result being that in many places features of rare interest are produced. The Harney Peak area of the southern Hills, with its bold pinnacles and shoulders of coarse, bare granite, rising from their forest-clad base of metamorphosed sedimentary rocks, presents a beautiful landscape, while the steep-walled canyons of Spearfish creek, Rapid creek and Elk creek in the Northern Hills are among the most picturesque that America can show. Again to the northwest along the upper Belle Fourche valley, where the nearly horizontal sandstones and shales have been intricately carved by the various streams and where the brilliant and various colors of the several formations harmoniously blend with a wealth of forest and pasture overlooked here and there by the stately, sombre forms of prophyry buttes, there is presented a view well worth many a hardship to see.

The climatic conditions of the Black Hills proper are scarcely excelled anywhere in the United States. The rainfall is not heavy, but is generally sufficient and the chief precipitation comes during the planting and growing season when most needed. Aside from this, clear, mild days prevail through much of the year. Extreme cold and extreme heat are exceptional and of short duration.

The mining interests of the Hills are of paramount importance, but large industries, particularly forestry, agriculture, horticulture, stock raising and manufacturing share in the fundamental occupations of the pople. The mineral products are gold,

silver, lead, copper, tin, tungsten, mica, spodumene, amblygonite, fullers earth, volcanic ash, and sructural material, including clay, gypsum, refinite, cement ingredients, and building stones. Lignite occurs in great quantity north and northeast of the Black Hills. This is now being mined in many places in small quantity and recent action of the legislature has provided opportunity to greatly develop the industry. The mineral production since the first mining in 1875 is approximately $270,000,000.

In addition to the natural features of the region, the political, social, educational and moral status of the people is commendable to a marked degree. Few new countries show a greater percentage of cultured men and women interested in the healthy advancement of a whole region and in the all-round development of every individual. Communication with all parts of the Hills is facilitated by good automobile roads, and railroads are convenient to every important district. The main lines connected with other parts of the country are the Chicago and Northwestern railway, the Chicago, Burlington and Quincy railway, and the Chicago, Milwaukee and St. Paul railway. Rapid City is on the line of the Chicago and Northwestern connecting with Omaha, also on the line of the same road connecting with the eastern part of the state, through Pierre, and on the Chicago, Milwaukee and St. Paul connecting with the eastern part of the state through Chamberlain. It has also connection with the Burlington system by means of the Rapid City, Black Hills and Western railway from Rapid City to Mystic.

Rapid City is a growing city of about 7,000 inhabitants. It was founded in 1876 and is considered by many as the most beautifully located city in the Black Hills. It is situated on Rapid Creek 3,200 feet above sea level, and a half hour's walk takes

one either out on the plains or into the hills. It offers many advantages as a college and residence city. There are eight churches, a good hospital, a fine opera house, four banks, a United States land office and weather bureau, wholesale and retail mercantile establishments, various manufacturing enterprises, many rooming houses, good hotels and enterprising newspapers. The city has also an excellent system of water works fed by springs four miles back in the hills; a modern illuminating gas works, a sewer system, and a hydro-electric plant furnishing light and power.

The people of Rapid City are interested in the welfare of the school and in addition to the usual social advantages of the place, opportunity is not infrequently given the students living elsewhere to enjoy the pleasures and influences of the best homes of the city.

The distance to the chief gold mining districts of the northern Hills near Deadwood and Lead is less than fifty miles. The mining districts of the central Hills west and southwest of Rapid City are nearer. This gives the student convenient access to active mining operations whenever desired and at the same time prevents undue distraction liable to result were the school in the midst of the hurry and hustle of mines and mills.

A particularly helpful feature, the value of which cannot well be overestimated, is the opportunity the students have for working in the mines and mills of the Hills during the summer vacations. This work following the year's schooling not only surpasses the ordinary summer mining course in the gaining of practical information, but to the energetic student, is also a source of ready cash.

Electrical Engineering and Civil Engineering Courses.

The School of Mines has from the early days of its organization maintained classes in various

branches of Civil Engineering and for a considerable number of years it has done the same in Electrical Engineering. The laboratory and field equipment necessary for the giving of proper instruction in these engineering studies has grown in proportion to the needs of the institution and now serves to give the usual four year courses in these subjects. In the purchase of apparatus for teaching these engineering courses efficiency has been the guiding feature and the apparatus is the best obtainable.

The varied development in the Black Hills region during the past several years has added emphasis to this work and to the urgent need for these courses. In Civil Engineering there is road making, bridge building, railroad construction, mine surveying, irrigation work and the various phases of mining and municipal problems. In Electrical Engineering there are particularly the hydro electric and the steam electric plants for the generating of light and power for mines and metallurgical plants, manufactories and municipalities. Five hydro electric plants on as many different mountain streams of the Black Hills and costing more than two and a half million dollars serve to indicate the present trend of activity and to indicate the latent possibilities of our swifter streams. Several thermo electric plants are also in operation.

Buildings and Grounds.

The buildings in which the work of the School is carried on are four in number: First the original School of Mines building, a commodious brick structure, three stories in height, situated in the west part of the grounds, and at present time devoted to modern languages, biology and shop work. It contains class rooms for the study of languages, mathematics, and history, a laboratory for biology, and a small workshop. It is heated throughout by

steam from the central power plant and is lighted by electricity.

The Main Building is a large, brick structure, with native sandstone trimmings, three stories in height, built in two wings. This building contains, in the front wing on the first floor, a large entrance hall, the President's and Registrar's offices, lecture rooms for Mathematics and English, and the Geological Museum; also, in the rear, the Library and the Department of Geology and Mineralogy, consisting of lecture room, office, map and mineralogical store rooms, and a thoroughly equipped mineralogical laboratory On the second floor are the Department of Chemistry and the Department of Civil Engineering. The chemical laboratories comprise the general, qualitative and quantitative laboratories, with balance room, supply rooms, lecture room and office, together with a private laboratory for the professor in charge. The rooms for the Department of Civil Engineering consist of professor's office, two large drawing rooms, a lecture room, supply rooms and a room equipped for making blue prints. In the basement are the physical laboratories, an experimental room, lecture rooms, store rooms, a locker room, and lavatories.

The Metallurgical building is 138 feet by 60 feet in plan, two stories high, built of brick covered with cement. This building is devoted exclusively to the Departments of Mining and Metallurgy, and to the work of the State Mining Experiment Station. It contains, on the first floor, a large laboratory for advanced metallurgical chemistry, a well equipped balance room, containing massive concrete piers for the mounting of balances, chemical laboratory and supply room, assay laboratory and a large assay furnace room. In the rear of the assay furnace room is the metallurgical machinery and apparatus and storage bins for ore and fuel. On the second floor are the lecture rooms of the Depart-

ments of Mining and Metallurgy, offices of these departments, and the mining and metallurgical museum.

The heating plant supplies heat for the buildings mentioned above, and power for the metallurgical and other laboratories by means of two 35 K. W. steam turbines connected to direct current generators. A third turbine unit similar to the above, but of seven K. W. is available for experimental work, and a three-panel switch board supplies connections.

The engineering building, appropriation for which has been provided and the erection of which is now underway, will add greatly to the facilities of the institution and will serve to house needed apparatus not hitherto obtainable.

EQUIPMENT

The institution when providing itself with apparatus endeavors to secure the most serviceable manufactured and care is taken to see that every piece is kept in as good condition as possible. Effort is made to see that every student has proper facilities in all of the laboratories and he is taught to realize that the grade of materials used deserve the high quality of work expected.

Library

The library occupies a well lighted room on the first floor of the Main Building, where all students may find a quiet place for study and have direct access to more than 7,500 bound volumes. Carefully selected general and scientific reference books supplement the most important standard works on Metallurgy, Mining, Geology, Chemistry, Engineering, Physics, Biology, Mathematics, English, History, Sociology, Economics, and Efficiency.

Many authoritative scientific and technical journals and transactions published by the leading societies and organizations of the United States and foreign countries, keep the library in touch with recent advancement in science. These journals are available for ready reference through the monthly periodical indexes received. Complete or nearly complete files of many of these journals may be found among the bound volumes.

The library is a repository of the documents of the United States Geological Survey, many of the state geological surveys and surveys of some of the foreign countries. The Bureau of Mines publications and other scientific bulletins of the United States government also are being received.

All students have direct access to the shelves and are thus able to make the best possible use of

the library. Books commonly consulted for reference may not be removed from the room but others by special arrangement may be withdrawn for a period of two weeks. The privileges of the library are extended to those not attending the institution. Arrangement for these should be made through the librarian. The librarian will gladly assist all patrons in finding the desired information.

The following named complete sets will serve to indicate the well selected nature of the scientific and technical literature available:

	Vols.
Transactions American Institute of Mining Engineers	60
Transactions British Institute of Mining Engineers	56
Engineering and Mining Journal	106
Mineral Industry	27
Coal Age	15
Concrete and Cement Age	14
Journal Iron and Steel Institute	99
Journal Institute of Metals	22
Engineering News	82
Engineering Magazine and Industrial Management	58
Engineering Index	15
Transactions American Inst. of Electrical Engineers	37
Transactions Inst. of Mining and Metallurgy	23
Journal American Chemical Society	43
Chemical Abstracts	15
Transactions American Electro Chemical Society	34
Journal Society of Chemical Industry	38
Zeitschrift fur Anorganische Chemie	57
Chemical and Metallurgical Engineering	19
Journal Industrial and Engineering Society	11
Journal Chemical, Metallurgical and Mining Society of South Africa	17
Bulletin Geological Society of America	30

Journal of Geology 27
Journal of Economic Geology 14
International Geological Congress—Special Reports on Coal and Iron..... 7
Physical Review..... 49
American Journal of Science..... 198
Proceedings Royal Society of London..... 90
U. S. Bureau of Standards..... 14
National Geographic Magazine..... 29
U. S. Geol. Survey Publications (Including Monographs, Professional Papers, Bulletins, Water Supply Papers, Mineral Resources, etc.)..... 400

There are also sets for general references such as:

Pooles Index of Periodicals, 1802-1906.
Readers Guide to Periodical Literature, 1900 to date
U. S. Catalog of Books in Print 1912 to date.
Congressional Document Catalog..... 12
National Cyclopedia of American Biography..... 16
Cyclopedia of Education..... 5

Also some of the well known historical and literary monthlies, for example:

Atlantic Monthly..... 124
American Review of Reviews 57
Century Magazine..... 99

In addition to the above there are many sets and partial sets of periodicals and atlasses and maps for which there is no room here for listing. These and the many standard single volumes have been selected with care and few liboraries of its size can show a better series of up to date useful volumes.

Drawing Rooms.

In the Department of Civil Engineering are two large drawing rooms—one for Freshman work, the other for Sophmore and Junior work.

The rooms are well lighted and fitted with especially designed drawing desks, each desk containing lockers in which students take care of their

supplies. Between the two drawing rooms there is a small room for the making of blue prints. It contains the blue print machine, sliding on a frame in the window, with south exposure so that sunlight is available for the greater part of the day. Sinks for washing blue, brown and black prints are provided.

Chemical Laboratories.

There are four chemical laboratories in the Main Building—one for general chemistry, one for qualitative analysis, one for quantitative analysis, and a special laboratory for fuel and water analysis. The quantitative and qualitative laboratories are equipped with large individual desks with acid proof tops, each desk being supplied with gas from the city mains. Between the desks are sinks with flowing water. An electrolysis bench with electrical connections for electrolysis apparatus and for heating appliances is also available. The laboratories are also supplied with compressed air and with apparatus for suction. Each student receives a separate and complete set of reagent bottles and supplies. The laboratories are well lighted and provided with ample hoods to carry off fumes. The quantitative laboratory is equipped with a separate weighing room in which are analytical balances of standard makes. In addition to these laboratories there is a private laboratory for the professor of chemistry, a special dark room for spectroscopy, a dark room to be fitted for photo-chemistry, and two supply rooms from which the students get their apparatus and chemicals as needed.

The apparatus is ample for all mineral, alloy and rock analysis, as well as for research along certain lines. The special apparatus includes combustion furnaces, apparatus for gas analysis, facilities for electro-chemistry, calorimeters for fuel analysis, spectroscopes for qualitative experiments, and elec-

troscopes for determination of radium and uranium in waters, gases, and minerals.

Biological Laboratory.

This laboratory is equipped with high class apparatus and materials. Compound and simple microscopes are provided the student for the study of forms, structures, interrelation of parts and functions and camera lucidas and a projectionscope allow for the execution of careful drawings. Several hundred thin sections of animal and plant forms are available for study and three kinds of microtomes are for use in making sections. There are also excellent anatomical models of one or more forms of the principal groups of animals, a number of imported charts showing growth habits, skeletons, including that of the human, bacterial apparatus, and a large aquarium with living forms for the study of habits, interdependence of organisims and the relation of organisms to their surroundings.

Physics Laboratory.

The Physics Laboratory is located in the basement of the Main Building. It has a cement floor and the tables are on cement pillars, thus securing stable foundations for such apparatus and instruments as require them. The laboratory is well equipped for accurate experimental work. Among the more important pieces of apparatus are precision balances, air pumps, acceleration apparatus and Atwood machine; a variety of apparatus for specific gravity, including hydrometers, Jolly balances, Westphal balances, etc., large Steinheil spectroscope, large vernier spectrometer, precision apparatus for complete measurements in interference, diffraction, polarization and dispersion of light; apparatus for sound measurements; complete equipment for determinations of specific heat, heat of combustion, heat of vaporization, etc., complete apparatus for the determination of the mechanical

equivalent of heat, seconds clock with electrical attachment; barometers, precision thermometers and pyrometers, air thermometers, Beckman thermometers; and a complete line of instruments for electrical measurements, including Weston voltmeters, ameters and wattmeters for a variety of ranges, Weston and Paul alternating current voltmeters and ammeters, Leeds and Northrup potentiometer, Leeds and Northrup precision wheatstone bridge, Kohlrausch bridge, standard condensers, Siemens electrodynamometers, Braun hot wire meters, Nalder Bros. standard inductance, Weston, Leeds & Northrup, and Cambridge Scientific Instrument Co.'s galvanometers, Braun electrometers, Dolezalek quadrant electrometer, aluminum and gold leaf electrometers and electroscopes, magnetometers, voltmeters, standard resistances; also completely equipped switch boards for both high and low voltage distribution of direct or one, two or three phase alternating current, and many special pieces of electrical apparatus, as Tesla transformers, induction coils, X-ray apparatus, spark and arc spectrum appartus; a variety of dynamos, motors, motorgenerator set, induction machines, gasoline engines and models of steam and gas engines.

The School also posesses a completely equipped wireless telegraph station consisting of a sending set of one KW capacity and sensitive receiving sets for long distance messages Among the larger pieces of apparatus is a Westinghouse 10 K. W. rotary converter designed for many different kinds of experimental work and embodying in itself the features of a number of different electrical dynamo machines. It is designed to be operated upon either alternating or direct current and will act as a generator or as a motor. When using alternating current its operation may be one, two or three phase. Complete switchboard equipment is provided for its control in any one of its many modes of operation

and includes a complete set of high grade measuring instruments for both alternating and direct current measurements. These include ammeters, voltmeters, wattmeters, power factor meters, frequency meters and dial synchroscope, all mounted on white marble panels which also carry the A. C. and D. C. circuit breakers, switches, plugs, etc. These switchboards also control a General Electric Company's 15 H. P. three phase induction motor with phase wound motor and drum control for variable speed service. This machine may be connected to the rotary converter above described by a link belt silent chain for full load tests on either machine. The equipment also includes a one K.W. motor generator set consisting of a single phase induction motor and a shunt wound generator. There are also a number of smaller A. C. and D. C. motors of various types. In addition to the above, the school heating and lighting plant and the equipment of the Departments of Mining and Metallurgy afford the student opportunity for making tests on dynamos and motors, engines and turbines of commercial sizes. The laboratory is well equipped with tools and work benches for the construction of special pieces of apparatus.

Apparatus for Civil Engineering.

The School of Mines is well equipped with surveying instruments for all kinds of plane surveying. It possesses one Gurley Y level, one Dietzgen Y level, one Berger Dumpy level, one Bausch and Lomb precision level, three Gurly transits, one with solar attachment, one Keuffle and Esser transit with Saegmuller solar attachment, one Dietzgen transit with auxiliary mining telescope, one Ainsworth transit with auxiliary mining telescope, one Bausch and Lomb mining transit, one Keuffel and Esser plane table, one Keuffel and Esser sextant, one clinometer, one planimeter, together with com-

plete equipments of stadia rods, leveling rods, range poles, field glasses, tapes, chains, axes, etc. The topography of the lands near the school offers excellent opportunity for all kinds of field work, with every degree of difficulty from flat prairie to the most rugged of rough hill country.

A Riehle cement testing machine is available for testing cement briquettes.

Assay Laboratory.

The assay laboratory contains a room in which the students are provided with individaul desks pulp balances for the mixing of assay charges; a balance room provided with concrete foundation piers; the pulp room in which the ore samples, etc., are crushed and sampled, and the furnace room in which furnace work is done exclusively. This furnace room contains a gasoline assay furnace and three double muffle-furnaces, heated by soft coal. These are placed in openings in a heavy dividing wall, separating the machinery hall from the front part of the building. In this way the front of the furnaces with the muffle openings are in the furnace room, flush with the wall, while the firing and taking out of the ashes is done on the other side of the wall, thus avoiding the dust and dirt in the main work room. Large gas furnaces are available for experimental work, such as roasting, smelting, annealing, etc.

The balance room is provided with Ainsworth, Heusser, Eimer & Amend, Thompson, and Keller balances. In the pulp room an electric motor furnishes power for the small Gates sample crusher and a sample grinder. A Calkins automatic cupel machine is used for making cupels. A large number of ore samples, including ores from many parts of this country are provided in great variety, also many types of furnace products, such as mattes,

flue dust, fume, and umpire sample for close checking work.

Mining and Metallurgical Laboratories.

There are two metallurgical laboratories in the Metallurgical Building; one in which are conducted metallurgical experiments as outlined in Metallurgy 7, and the other in which the various metallurgical processes are performed on a commercial scale.

The experimental laboratory is equipped with individual desks provided with gas and air; analytical and pulp balances, hot plates, and water sinks; a complete cyanide plant of ten pounds capacity, consisting of a Trojan ball mill, high pressure blower, a Pachuca agitator and filter press; a Braun cyanide plant, a Hendryx mechanical agitator; gas and electric furnaces, pyrometers, potentiometers and platinum resistance pyrometer, Parr and Mahler-bomb calorimeters, electrical measuring instruments, etc.

The commercial laboratory is designed to illustrate chiefly the metallurgy of gold, silver, copper and lead. It is best adapted to handle ore in quantities of from three to five tons, but larger quantities may be treated if necessary.

The crushing machinery consists of a No. O Gates breaker, a pair of 16x10 inch rigid rolls, a 6x4 inch Bosworth jaw crusher, a 10x4 ft. Alsing tube mill, a 3½ ft. Huntington mill and a 3-300 lb. stamp battery and amalgamating plates.

The cyanide plant consists of two 5x3 ft. sand tanks, two 5x5 ft. slime tanks, two 4x3½ ft. solution storage tanks; two 4x3½ ft. gold solution tanks and two zinc boxes. For the agitation of slime a 10x2½ ft. Pachuca tank is used, while for slime thickening and filtration a 5 ft. Callow cone and small Moore vacuum filter are employed. The accessory apparatus for cyanidation consists of four 1½ inch centrifugal pumps, a vacuum pump,

an air compressor and receiver, and three electric motors for power, etc. The above plant is extremely flexible, so than any variation from an all-sand to an all-slime process can be demonstrated on a commercial scale.

The ore dressing apparatus consists of a Traylor table, a Frue Vanner, two classifying cones, an impact screen, a Vezin sampler, and a Jarvis experimental jig.

The present oil flotation apparatus consists of a complete Callow laboratory machine, a modified Hoover machine, and a slide machine. Important additions are contemplated for the coming year.

The smelting machinery consists of a 30-inch blast furnace which may be used for either lead or copper smelting, forehearths, slag cars, and other accessories; a small Bruckner roasting furnace, and a Green rotary blower. The crushing and cyaniding and concentrating machinery is so placed that any combination of apparatus desirable may be secured and practically every possible system of treatment worked out.

Metallographic Laboratory

This laboratory is equipped with four metallographic microscopes, microphotographic apparatus, polishing machines, etc., and much pyrometer apparatus, of various kinds, including potentiometer, resistance boxes, etc. Electric furnaces are provided for heat experiments and for metallography.

Mineralogical Laboratory.

This is a large room well equipped with low tables arranged for study and determination of minerals. Students are provided with the necessary reagents and apparatus, by the department. Each student has his own locker. A large working collection of carefully labeled minerals available for students' use is kept in specially designed cases ready

of access, and a considerable collection of unknown minerals is at hand for determination.

For advanced work in mineralogy, petrography, and geology the department has several excellent Leitz and Zeiss petrographic microscopes, and a Bausch and Lomb binocular mircoscope of latest type. The laboratory is also equipped with a Sauveur and Boylston polishing lathe, for the preparation of polished sections of the opaque minerals.

Geological Museum.

This museum is an important feature in the equipment of the School of Mines. Its contents have been chosen to assist in the teaching of geology, mineralogy, petrography, and paleontology, rather than to become a storehouse of curiosities. The room has a floor area of thirty-six by forty-seven feet, is twelve feet high, and is lighted by ten large windows.

Two kinds of cases are used for the display of specimens—central cases and wall cases. There are eight central cases of oak, each consisting of two parts of three compartments each, with glazed tops, and a six compartment massive base; the whole constructed in such a manner as to serve practically as two sections, fitting tightly back to back. The display surface under glass is nearly fifty square feet for each case. The bases are especially designed for the storage of material not needed for constant exhibition.

The wall cases have glazed doors. Each is seven feet six inches high and contains three double door compartments of six shelves. The cases are particularly adapted for the display of large specimens.

Cases one and two and four contain a general collection of minerals arranged according to Dana's system of classification. Case three contains a se-

ries of specimens to illustrate general features of mineralogy, geology and petrography. Case seven contains a collection of well preserved fossils, carefully selected to show the more prominent features of paleontological interest. Cases five and six contain representative collections of Black Hills minerals, ores and rocks. Case eight contains Cretaceous and Tertiary fossils from the Black Hills region, mainly from the Cheyenne river and the White river Badlands.

The wall cases are for large specimens of all classes, some of which are very beautiful. The collection from the Black Hills is especially noteworthy.

The museum contains two large relief maps of the Black Hills made by E. E. Howell of Washington City for the St. Louis exposition, also a very valuable and unique ore section of the Homestake mine, donated by the Homestake Mining Company, of Lead, South Dakota. Many framed maps of mines and important geological regions adorn the walls and serve as an added educational feature of the room.

The collection of minerals exhibited by the school at the St. Louis Exposition, 1904, received a diploma and gold medal, as did also the Black Hills relief maps.

Mining and Metallurgical Museum.

This is situated on the second floor of the Metallurgical Building, in a large, well lighted room and contains wall cases for the display of specimens. It has a fair collection of furnace products, such as slags, mattes, alloys, fuels, refractory materials, and wall boards and hoisting ropes and screens, safety lamps and models of head frames and similar materials. In time it will become a valuable adjunct to the teaching of mining and metallurgical subjects. It is added to from time to time by man-

ufacturers and mining companies, who donate exhibits. Occasional purchases are also made.

Publications.

The school publishes at irregular intervals bulletins of greater or less length on subjects covered by its various lines of activity. These may be obtained free of cost by persons interested so long as there are copies in stock. Twelve have been published. They are as follows:

Bulletin No. 1—Preliminary Report of the Dakota School of Mines upon the Geology, Mineral Resources and Mills of the Black Hills of Dakota; 171 pages. 1888. By F. R. Carpenter and H. O. Hofman. **(Out of Print.)**

Bulletin No. 2—Notes on the Geology and Mineral Deposits of a Portion of the Southern Black Hills; 41 pages, 1899. By C. C. O'Harra and A. Forsyth.

Bulletin No. 3—Cyanide Experiments on the Siliceous Ores of the Northern Black Hills, etc.; 27 pages. 1900. By A. Forsyth and G. H. Clevenger.

Bulletin No. 4—Two papers: A History of the Early Explorations, and of the Progress of Geological Investigation in the Black Hills Region; and A. Bibliography of Contributions to the Geology and Geography of the Black Hills Region; 88 pages. 1900. By C. C. O'Harra. **(Out of Print.)**

Bulletin No. 5—The Cyanide Process in the Black Hills of South Dakota; 88 pages. 1902. By C. H. Fulton. **(Out of Print.)**

Bulletin No. 6—The Mineral Wealth of the Black Hills; 88 pages. 1902. By C. C. O'Hara. **(Out of Print.)**

Bulletin No. 7—Metallurgical Practice in the Black Hills of South Dakota; 63 pages. 1904. By C. H. Fulton.

Bulletin No. 8—The Cement Resources of the Black Hills; 55 pages. 1908. By C. C. O'Harra, M. F. Coolbaugh, M. A. Ehle Jr., and C. H. Fulton.

Bulletin No. 9—The Badland Formations of the Black Hills Region; 152 pages. 1910. By C. C. O'Harra. **(Out of Print.)**

Bulletin No. 10—The Minerals of the Black Hills; 200 pages. 1914. By Victor Zeigler. **(Out of Print.)**

Bulletin No. 11—A Bibliography of the Geology and Mining Interests of the Black Hills Region; 225 pages. 1917. By C. C. O'Harra.

Bulletin No. 12—The Occurrence, Chemistry, Metallurgy and Uses of Tungsten with Special Reference to the Black Hills of South Dakota. By J. J. Runner and M. L. Hartmann, including a Bibliography of Tungsten by M. L. Hartmann. 264 pages. 1918.

THE PAHASAPA QUARTERLY

This magazine, the first number of which was issued in December, 1911, is published by the faculty and students of the institution. As the name indicates, it appears four times during the school year and is devoted to the interests of the School of Mines and the Black Hills region. It contains articles of interest to engineers generally and to the students and alumni of the School of Mines especially.

The magazine has contained many papers of timely importance and several times a special number has dealt almost entirely with one particular subject, for example, the Tungsten number, the Northern Black Hills number, the Manganese number, the Lignite number, the Good Roads number, and the Students Army Training Corps number. The following individual papers serve to illustrate the general nature of the articles presented

Climatic Characteristics of the Black Hills.

Lithium, Its Occurence, Uses, Determination and Methods of Extraction.

Water Power Possibilities of the Black Hills.

Tin, Occurrence in the Black Hills and Methods of Analysis.

Radium and Its Geological Significance.

Limitations of the Fire Assay.

Notes on Molybdate and Sulphate Methods for Determination of Lead.

Mill Construction and Costs.

Flotation of Minerals.

An Investigation of the Irrigation Possibilities of Little Elk Creek.

An investigation of the Extraction of Potash from Feldspar.

Cambrian Blue Siliceous Ores of the Black Hills

The Angostura Irrigation Project.

The Belle Fourche Dam and Irrigation Project.
The Homestake Mine.
The Golden Reward Roaster.
The Viscosity of Blast Furnace Slags at High Temperature.
Flotation of Gold Ore.
Metallurgy and the War.
The Geology of Petroleum Deposits.
Oil Well Drilling.
The Refining of Petroleum.
The Engineer in War.
The Engineer After the War.
Lignite Coals and Their Utilization.
Sampling and Analyzing Coal.
The Origin of Pete.
The Origin of Coal.
Roads: Past, Present, Future.
The Largest Known Beryl Crystal.
The Field for Research in Nonferrous Metallograhpy.
Water Pool Calcite, An Interesting Cave Mineral.
Columbite Crystals from the Black Hills.

STUDENTS EXPENSES

Tuition.

The tuition and incidental fee is $6 per semester, or $12 per year, payable in advance on registration. This fee is the same to residents and nonresidents of the state.

According to Section 209 of the Political Code, 1903, page 40:

"The regents shall fix all rates of tuition and other fees, to be paid by students, but such rates shall be the same in all the different institutions. They may receive, in any one of the institutions under their control, free of tuition, two students, appointed by each State Senator and one by each Representative of the State Legislature, which appointees shall be residents of their respective districts or counties, and whose term shall expire with the term of office of said senator or representative, provided that such appointees shall comply with all the rules and requirements of the institution which they desire to enter. No student, however, shall receive any other gratuity whatever."

The 1919 session of the Legislature modified the tuition requirements for residents of South Dakota, who have seen military service. Part of this enactment is as follows:

Section 1: That Section 5577 of the South Dakota Revised Code of 1919 is hereby amended to read as follows:

Section 5577: (Tuition Free—Veterans), Any person residing in this state, who has served in the army or navy of the United States during any war in which the United States has been engaged, including members of the South Dakota National Guard, who performed military service outside of the borders of this state, and has been honorably discharged from such service, has been furloughed

into any reserve branch of the military or naval service of the United States, or who performed active war service, such as nursing or assisting in the care of soldiers and sailors in any government hospital, field or camp, as a member of the Red Cross or any other similar organization engaged in war relief work, which shall have been recognized and approved by the government of the United States, during any of the periods herein before mentioned, shall upon complying with all the other requirements for admission be entitled to attend and pursue any course or courses in any state educational institution, under the control and management of the Board of Regents of this State, without the payment of charges for tuition. It shall be the duty of the Board of Regents to determine who are entitled to the benefits of this act. The term "honorably discharged" shall be construed to include the terms, "good discharge" and "release from active service."

Laboratory Fees and Deposits

The fees named below cover only the cost of materials and supplies necessarily consumed in the laboratory courses mentioned. All fees and deposits must be paid on registration at the beginning of each semester.

Chemistry 3, General and Qualitative Chemistry	$ 5.00
Chemistry 4, Qualitative Analysis	5.00
Chemistry 5, Quantitative Analysis	6.00
Chemistry 6, Quantitative Analysis	6.00
Chemistry 7, Metallurgical Analysis	6.00
Metallurgy 7, Pyrometry	5.00
Metallurgy 10, Cyanide Testing	5.00
Metallurgy 2, Assaying	5.00
Students' Activities Fee, required of all regularly enrolled students, per semester	3.00
Fee for bachelor's degree	5.00
Fee for advanced degree	10.00
Fee for permit for "conditioned" examination	2.00

The deposits named below are made to cover the cost of breakage and extra supplies used in the courses named. The unused portion of each deposit will be returned to the student at the end of the school year.

Civil Engineering, deposit ..... $ 5.00
General Mineralogy 5.00
Metallurgy 10, Cyanide Testing, deposit 10.00
Metallurgy 2, Assaying, deposit 20.00
General breakage deposit for students taking laboratory courses in Chemistry or Metallurgy (Per course) 5.00

Other Expenses of the Nature of Fees

The Department of Engineering furnishes supplies for the mechanical drawing courses, practically at cost.

Engineering 1-2, Mechanical Drawing, will cost approximately $5.00 for the year, exclusive of drawing instruments, which the student purchases on his own account, prices ranging from $12.00 up for a good set of instruments.

Engineering 3-4, Descriptive Geometry, will cost approximately $2.00 for the year.

Engineering 7, Topographic Drawing and Engineering 9, Machine Design, will cost $2.00 for the year.

Living Expenses

Students will find living expenses in Rapid City approximately the same as in other parts of the country. In order to lessen these expenses as much as possible, the School of Mines maintains a dining hall in which meals are served at cost. Effort will be made to keep the charges for the coming year as near the earlier figures as market conditions will allow. Rooms may be obtained in the city with private families or in boarding houses or hotels.

Incidental Expenses

Students are required, at various times, to take part in the local geological, mining and metal-

lurgical field trips. The geological trips of the Freshman year usually cost the student about $10. The surveying trips in the Sophomore year will cost about $12. Trips in the Junior and Senior year, for mining and metallurgical exploration, cost a similar sum.

Opportunities for Self Help

Opportunity for self help in a city the size of Rapid City is necessarily limited. The growth of the place however is such as to keep up a considerable demand for help of many kinds and almost any worthy, industrious student can find employment. It is to be borne in mind that the course of study is an arduous one and requires the student's best effort, and if conscientiously and satisfactorily performed, will leave comparatively little outside time in which to earn money.

Some students find employment which nets them their board and lodging by doing chores in private families or assisting in some of the stores, shops, mills, or manufacturing plants. Some find employment in the boarding houses. The school is able to assist a few students, to some extent, by employing them in the capacity of assistant janitors and similar work.

Students who have become acquainted, by a residence in town for a year or two, find it easier to obtain work than strangers. For this reason it is essential that a student who comes as a stranger to enter the school should be provided with sufficient funds to carry him through the first year, at the very least.

SCHOOL ACTIVITIES

Students' Association.—The students have always maintained one or more organizations for the direction of student activities. Recently, in order to better correlate all of these activities, the Students' Association was formed. As stated in the Consitution, the object of the Association, is to provide a representative body of students which, by virtue of the position of influence of its members, in student affairs, shall be able to supervise and control all non-academic activities of the student body as a whole; second, to bring about a closer union of student organizations and to establish a more effective control of non-academic student affairs; third, to provide a suitable medium through which student opinion may be presented to college authority and the opinion of the college authority may be presented to the students.

Athletics.—The institution heartily encourages athletics within the proper limits. An all school year athletic director is provided.

Orchestra and Glee Club.—The Orchestra and the Glee Club, each of which is under the direction of a trained musician, were organized to accommodate such students as are musically inclined. There is no special charge to the student for instruction, his activity fee covering all costs.

Students' Activities Fee.—A fee of $6.00 per year is expected of all students in order that activities not otherwise provided for, may be properly financed. The payment of this fee, gives the student access to athletic grounds, payment for admission to games, provides him with athletic and other like material when needed, and subscription to the school magazine the Pahasapa Quarterly.

MINING EXPERIMENT STATION

The School of Mines aims to assist the prospector and mining man in every reasonable way in determining the nature and value of such rocks, minerals, and ores as he may have and in solving the technical problems in connection with their utilization. For many years members of the institution have given a considerable part of their services to the determination of minerals and rocks and to the assaying and analyzing of samples sent in for determination. A large amount of experimental work has been done in order to learn the most economic methods of extracting values from ores. More re-recently the state has appropriated money to carry on the investigations in systematic manner and an experienced analyst is in charge of the work. Every effort is put forth to make the service available at little cost to all people of South Dakota who may be interested. Assays for gold and silver are made for twenty-five cents per sample. Many qualitative analyses are made free and quantitative analyses are made at as low rates as possible. Prices will be sent upon application. All samples for analysis or assay and letters accompanying the same may be addressed to the Mining Experiment Station, State School of Mines, Rapid City, South Dakota.

REQUIREMENTS FOR ADMISSION

Freshman Class

Requirements for admission to the Freshman class are as follows:

Fifteen units are necessary for entrance.

Required Units

Algebra	1.5 units
Plane Geometry	1 unit
Solid Geometry	0.5 unit
English	3 units
History	1 unit
Physics	1 unit
Chemistry	1 unit
Total required units	9 units

Elective Units

French	1, 2 or 3 units
German	1, 2 or 3 units
Latin	2, 3 or 4 units
Greek	1 unit
Spanish	1 or 2 units
English	1 or 2 units
History	1 or 2 units
Algebra	0.5 unit
Science	1 or 2 units
Drawing	1 unit
Shop Work	1 unit
Civil Government	0.5 unit
Bookkeeping	1 unit
Elective units required for entrance	6 units

A unit course of study is defined as a course covering a school year of 36 weeks with 5 periods of at least 45 minutes each per week.

Methods of Entering the School

Graduates of accredited High Schools in the state of South Dakota and other states will be pro-

visionally admitted without examination, if they present proper credentials, certifying to the fact that they have completed the studies mentioned under the requirements for admission.

Other candidates for admission will be given credit for so many of the fifteen necessary units as they may bring credentials for, and will be permitted to make up the remainder in the classes maintained as outlined below to meet the requirements of students entering without having had adequate High School facilities. Formerly these covered four full years. Beginning with the school year 1920-21 only the third and fourth years will be given. These years correspond pretty closely to the last two years of the best high schools but more emphasis is placed on subjects leading to scientific and technical careers.

The School of Mines faculty has direct supervision of the work. Two instructors devote practically their entire time to the department and several of the professors teach one or more subjects. The same laboratory facilities are afforded these students as are enjoyed by the higher classes.

Application blanks for entrance will be sent on request.

PREPARATORY SCIENCE COURSE

Third Year

First Semester—	Hours per Week Lectures.	Lab.
Biology 1—General Biology ..	3	3
English 5	5	..
French 1	5	..
Mathematics 3—Geometry ...	5	..
	18	3

Second Semester—	Lectures.	Lab.
Biology 2—General Biology ..	3	3
English 6	5	..
French 2	5	..
Mathematics 4—Geometery ...	5	..
	18	3

Fourth Year

First Semester—	Hours per Week Lectures.	Lab.
*Biology 3—Zoology or	3	3
*French 3 or *English 7.....	5	..
Chemistry 1	3	6
Mathematics 5—Geometry ...	5	..
Physics 1	4	6
	17 or 15	12 or 15

Second Semester—	Lectures.	Lab.
*Biology 4—Botany or	3	3
*French 4 or *English 8.....	5	..
Chemistry 2	3	6
Mathematics 6—Algebra	5	..
Physics 2	4	6
	17 or 14	12 or 15

*The student may select one of the three courses.

Special Students

Applicants for admission, who are gradutes of colleges or technical schools will be admitted as special students and permitted to take any subject they desire, taught in connection with the regular courses. Persons of mature age, who have been employed in mines and metallurgical plants and who desire to take up special courses particularly along the lines of mining, metallurgy and geology, will be admitted as special students, provided they show that they have sufficient foundation to take up the work with profit to themselves. No immature person will be permitted to take advanced courses, such as Assaying, Metallurgy, etc.

GENERAL STUDIES

The South Dakota School of Mines is frequently approached by students, both men and women, who have no wish to become engineers but who seek to enlarge their mental horizon by taking some of the subjects of more general interest offered in the several courses. To all such persons the School of Mines extends a cordial welcome and offers every facility at its disposal for their cultural benefit. The attention of persons so minded is called to the following list of subjects, all taken from the regular courses, which have a general educational value: English literature, foreign language—including French, German (Not given at present), and Spanish—history, sociology, economics, machematics, biology, geology, mineralogy, chemistry, physics, astronomy, drawing and by special arrangement civics and history. From these subjects a course may easily be selected corresponding to the first two years of a general college curriculum. Every effort will be made to give satisfactory attention to special students taking work along any of these lines. The only fees charged are the usual tuition and students' activities fees and such laboratory fees as may be required in courses taken.

Summer School

The summer school in surveying begins immediately after commencement and is arranged especially to accommodate students who are completing sophomore year. The electrical engineering students spend two weeks in plane surveying, the mining and metallurgical engineering students spend two weeks in plane surveying and one week in underground mine surveying, and the sttudents in civil engineering spend three weeks in surveying as outlined in the civil engineering course. Every effort

is exerted to make this work practical and instructive. The mine surveying is done in a suitable mine in the Black Hills, the remainder of the work is done in the vicinity of Rapid City.

Admission to Advanced Standing

Graduates of college and technical schools who enter the school as candidates for a degree will receive proper credit for all such studies which they have completed and which form part of the curriculum of the School of Mines. The faculty decide these cases upon the basis of individual merit.

Degrees

The school of Mines offers degrees as follows: Bachelor of Science in Mining Engineering, to the candidate who has successfully completed the regular Mining Engineering Course; Bachelor of Science in Metallurgical Engineering, to the candidate who has successfully completed the Metallurgical Engineering Course; Bachelor of Science in Civil Engineering to the candidate who has successfully completed the Civil Engineering Course; and Bachelor of Science in Electrical Engineering to the candidate who has successfully completed the Electrical Engineering Course.

Advanced degrees will be conferred upon candidates of the corresponding engineering course of the school, who shall have devoted one year at graduate study in the School of Mines, under the direction of the faculty, passing required examinations upon the studies pursued, or to those who shall furnish evidence of two years successful experience in technical work, and who shall submit an adequate theses which shall be duly considered and accepted by the faculty before such advanced degree will be granted.

Candidates for the advanced engineering degree should make application for such not later than

December 1st of the school year in which graduate work is begun.

In order to allow time for correspondence and corrections, the thesis of a non-resident candidate should be submitted not later than April 15th of the year in which the degree is to be granted. This thesis should be typewritten on paper 8½x11 inches in size. Two copies must be furnished; one for the department within which the thesis falls and one for the library.

The following is a list of some of the theses that have been submitted. This includes also theses formerly required of undergraduates.

Arentz, S. S. Some Experiments on Bromo-Cyanogen.

Hall, Arthur E. Some Features Illustrating the Quantitative Chemistry of the National Smelter Blast Furnaces.

West, Elmer W. Notes on Assay Slags.

Anderson, O. A. The Grand View Mining Property with Plan and Estimated Cost of Development Work and Reduction Plant.

Coolidge, E. B., and Gaines, Wm. N. The Metallurgical Treatment of Ore from the Queen Bee Property.

Curran, H. T. and O'Brien, B. D. Experiments on the Blue Ores of the Black Hills.

Read, John B. The Distribution of Gold and Silver in the Siliceous Ores of the Black Hills.

Seiter, Herbert, and Penhoel, L. C. Some Suggestions Relative to the Development of the Grand View Mining Property Near Silver City.

Smith, E. V. L. Development of a Low Grade Mining Property, Kittilas County, Washington.

Wetherald, Fred H. The Determination of Formation Temperatures of Certain Silicates.

Whytock, Peter R. Preliminary Notes on Some Supposed Nickeliferous Minerals of the Black Hills.

Bryant, Frank. An Investigation of the Different Cyanide Methods, as Applied to the Treatment of the Black Hills "Blue" Ores.

Ellerman, Otto. The Gordelia Mining Company of Rochford, South Dakota.

Matson, B. V., and Anderson, F. B. Report on the Hematite and Delaware Mines, Including Metallurgical Treatment.

Morris, Milton, and Cornell, W. L. Experiments on Slag Losses Due to Borax Glass.

Van Nuys, C. C. Plane Curves.

Wells, L. P., and Whitmore, C. F. Report on Coolgarde Group of Claims, Ida Gray Mining District.

Coolidge, Cyril, and Overpeck, Lem S. The Iron Deposits of the Black Hills of South Dakota.

Goodner, Ivan E. (With Professor C. H. Fulton.) The Constitution of Copper-Iron and Copper-Lead-Iron Mattes.

Ives, Glen P., and Ossa, Ignatio D. Metallurgical Treatment of Jamesonite Ores.

Sparling, Wm., and Winters, F. W. A Hypothetical Mine.

Betterton, J. O. The Determination and Separation of Antimony and Arsenic.

Coolidge, Roy F. The White Precipitates Found in Zinc Boxes.

Jones, H. W., Hvistendahl, E. S., and Read, H. N. The Standby Mine.

Ledyard, L. W. The Cleopatra Mine.

Eddy, John W., and Bennett, R. T. A Hypothetical Mine.

Jeffries, Zay, and Wheelock, H. E. Economic Resources of the Badlands.

Sargent, A. E., and Flower, G. E. The Development of a Hypothetical Mine and the Metallurgical Treatment of the Ore.

Saville, Joseph H. The Possible Development of the Deep Down Property and Treatment of Its Ore.

Stoner, J. W., and Elliot, J. W. A Hypothetical Mine.

Anderson, Wm. L. Investigation of White Precipitate in Zimmerman-Reinhart Method for Iron.

Brooks, Floyd R. Investigation Concerning the Melting Points of a Series of Copper Slags.

Ehle, Chester G. Gypsum Deposits and the Stucco Industry in the Black Hills.

Quinney, E. H., and Winsor, F. H. Jr. Cyanide Tests on a Refractory Siliceous Ore of the Northern Black Hills.

Willard, C. G., and Muhmel, F. J. Investigations of Fire Clays Near Rapid City.

Fahrenwald, Frank A. Report on the Rapid Valley Irrigation Project.

Anderson, Amil A. On the Cambrian Blue Siliceous Ores of the Black Hills.

Alder, Alfred. Experiments with the Quantitative Analysis of Lead.

Hartgering, J. M. Design of a Cement Plant.

Henton, Hugh M. Some Experiments in Analysis of Titanium, Magnesium, Zinc.

Bochert, W. C. Metallurgical Treatment of a Typical Refractory Siliceous Ore.

Eldridge, Robert B. Experiments in Ore Flotation.

Fahrenwald, Arthur W. Report on the Metallurgical Investigation of a Blue Ore.

Farnham, Lloyd L. Experiments on the Fine Grinding and Amalgamation of Jamesonite Ores.

Fleischman, Leo. Data on the Relative Fuel Consumption of Oil and Coal Fired Muffle Furnaces.

Hill, Robert S. Notes on Beryllium.

McCauley, Willard J. An Investigation of the Irrigation Possibilities of Little Elk Creek.

Meents, R. O. Leaching a Copper Ore.

Pryer, W. C. Investigation for a Volumetric Determination for Arsenic.

Stowell, George E. The Geology of Silver City and Vicinity.

Booth, L. E., and Thiel, Arthur. Electrolysis of Alkaline Solutions of Potassium Sulpho-cyanide.

Gates, C. E. The Design of a Plant for a Southeastern Missouri Lead Mine.

O'Harra, B. M. The Gold-Bearing Quartz-Tremolite Series of the Black Hills.

Cragin, Rodney S. Tests for Gold and Silver of the Country Rock of the Black Hills.

Dennis, Paul Joseph. Experiments in Making Brick from the Graneros and Pierre Shales.

Hill, Joseph Henry. The Refining and Recovery of Gold from Dental Scrap.

Smith, Elwyn L. Radio-active Minerals of the Black Hills.

Anderson, Amil. Homestake Stamp Mill Practice.

Bochert, Wm. C., and Price, Virgil T. Flotation of a Gold-Bearing Schist Ore.

Cremer, Frank. Burnt Gumbo and Its Adaptability for Improving the Highways of South Dakota.

Deutsch, Harry. The Metallurgical Treatment of Jamesonite Ore.

Clark, Edwin Espy. Some Changes in the Operating Characteristics of a 10 KW Synchronous Converter, Due to the Reduction of the Air-Gap.

Newbowers, Frank Joseph. Hydro-Electric Development for Farm Installation.

Stout, Herbert A. Experiments in the Treatment of an Arsenopyrite Concentrate.

Wong, Yu Chih. The Electric Treatment of Antimony. (Stibnite Sb_2S_3 from Gillham, Arkansas.)

Nelson, Harold Lee. Some of the Fundamentals Observed in the Improvement of Our Highways.

Hall, Ralph Julius and Mara, Hubert Wilbur. The Utilization of Columbium.

COURSES AND DEPARTMENTS

All engineering courses offered by the School of Mines require four years for completion. They are as follows: Mining Engineering, Metallurgical Engineering, Civil Engineering, and Electrical Engneering.

SYNOPSIS OF COURSES

MINING ENGINEERING COURSE

Freshman Year

First Semester—	Hours per Week Lectures.	Lab.
Chemistry 3—General and Qualitative	4	9
Civil Engin. 1—Mechanical Drawing.	..	6
English 9—Composition	4	..
Mathematics 7—Trigonometry	5	..
Shop 1—Woodwork	..	3
Modern Languages, Optional	3	..
	16	18

Second Semester—	Lectures.	Lab.
Chemistry 4—General and Qualitative	4	9
Civil Eng. 2—Mechanical Drawing	..	6
English 10—Composition	4	..
Mathematics 8—Analytic Geometry	5	..
Shop 2—Woodwork	..	3
Modern Languages, Optional	3	..
	16	18

Sophomore Year

First Semester—	Hours per Week Lectures.	Lab.
Chemistry 5—Quantitative Analysis.	2	6
Civil Engin. 5—Surveying	3	3
Geology 1—General Geology	4	3
Mathematics 9—Calculus	5	..
Physics 3—General	4	3
Shop 3—Forge and Machine	..	3
Modern Languages, Optional	3	..
	21	18

Second Semester—	Lectures.	Lab.
Chemistry 6—Quantitative Analysis.	2	6
Civil Engin. 6—Surveying	3	3
Geology 2—General Geology	4	3
Mathematics 10—Calculus	5	..
Physics 4—General	4	3
Shop 4—Forge and Machine	..	3
Modern Languages, Optional	3	..
	21	18

Junior Year

First Semester—	Hours per Week Lectures.	Lab.
Civil Engin. 7.—Topographic Drawing	..	3
Civil Engin. 12—Graphical Statics	..	3
Metallurgy 1—General	3	..
Mineralogy 1—General	2	6
Mining 1—Breaking Ground	3	..
Mining 3—Ore Dressing	3	3
Physics 5—Analytic Mechanics	4	..
Sociology 1 or Economics 1	3	..
Electives	2	3
	20	18

Second Semester—	Lectures.	Lab.
Civil Engin. 14—Mechanics of Materials	4	..
Metallurgy 2—Assaying	2	9
Mineralogy 2—Determinative	2	6
Mining 2—Tunneling, Shaft Sinking.	2	..
Mining 4—Ore Dressing	3	3
Sociology 2 or Economics 2	3	..
Electives	3	..
	19	18

Senior Year

First Semester—	Hours per Week Lectures.	Lab.
Geology 3—Economic Geology	4	..
Metallurgy 3—Gold and Silver	2	..
Metallurgy 5—Copper	3	..
Metallurgy 7—Pyrometry	..	6
Mining 5—Drainage and Transportation	2	..
Mining 7—Exploitation; Supporting Excavations	3	..
Mining 9—Elements of Structural Design	..	6
Electives	5	6
	19	18

Second Semester—	Lectures.	Lab.
Geology 4—Economic Geology	4	..
Metallurgy 4—Iron and Steel	3	..
Metallurgy 10—Cyanide Testing	..	6
Mining 6—Compressed Air	2	..
Mining 8—Ventilation, Lighting and Placer Mining	3	..
Mining 10—Elements of Structural Design	..	6
Electives	6	6
	18	18

Graduate Year

Electives and Fifth Year Subjects:

Mining 9-10—Mine Design.
Mining 12—Mine Examination.
Mining 13—Efficiency Engineering and Administration.
Mining 14—Safety Engineering and Hygiene.
Mining 16—Mining Law.
Mining and Metallurgical Reports.
Civil Engineering 15—Cement and Concrete.

Civil Engineering 16—Testing.
Civil Engineering 31—Specifications and Contracts.
Electrical Engineering 3-4.
Geology 5-6—Advanced Geology and Petrography.
Sociology or Economics 11, 12.
Thesis 11, 12.

Fifteen hours of work will be required and should be chosen from the list of elective subjects.

METALLURGICAL ENGINEERING COURSE

Freshman Year

First Semester—	Hours per Week Lectures.	Lab.
Chemistry 3—General and Qualitative	4	9
Civil Engin. 1—Mechanical Drawing	..	6
English 9—Composition	4	..
Mathematics 7—Trigonometry	5	..
Shop 1—Woodwork	..	3
Modern Languages, Optional	3	..
	16	18

Second Semester—	Lectures.	Lab.
Chemistry 4—General and Qualitative	4	9
Civil Engin. 2—Mechanical Drawing	..	6
English 10—Composition	4	..
Mathematics 8—Analytic Geometry	5	..
Shop 2..Woodwork	..	3
Modern Languages, Optional	3	..
	16	18

Sophomore Year

First Semester—	Hours per Week Lectures.	Lab.
Chemistry 5—Quantitative Analysis	2	6
Civil Engin. 5—Surveying	3	3

Geology 1—General Geology	4	3
Mathematics 9—Calculus	5	..
Physics 3—General	4	3
Shop 3—Forge and Machine	..	3
Modern Languages, Optional	3	..
	21	18

Second Semester—	Lectures.	Lab.
Chemistry 6—Quantitative Analysis.	2	6
Civil Engin. 6—Surveying	3	3
Geology 2—General Geology	4	3
Mathematics 10—Calculus	5	..
Physics 4—General	4	3
Shop 4—Forge and Machine	..	3
Modern Languages, Optional	3	..
	21	18

Junior Year

	Hours per Week	
First Semester—	Lectures.	Lab.
Chemistry 7—Metallurgical Chemistry	2	9
Metallurgy 1—General	3	..
Mineralogy 1—General	2	6
Mining 1—Breaking Ground	3	..
Mining 3—Ore Dressing	3	3
Sociology 1 or Economics 1	3	..
Electives	4	..
	20	18

Second Semester—	Lectures.	Lab.
Metallurgy 2—Assaying	2	9
Metallurgy 4—Iron and Steel	3	..
Mineralogy 2—Determinative	2	6
Mining 2—Tunneling, Shaft Sinking.	2	..
Mining 4—Ore Dressing	3	3
Sociology 2 or Economics 2	3	..
Electives	4	..
	19	18

Senior Year

First Semester	Hours per Week Lectures.	Lab.
Chemistry 11—Electro Chemistry...	2	..
Metallurgy 3—Gold and Silver	2	..
Metallurgy 5—Copper	3	..
Metallurgy 7—Pyrometry	..	12
Mining 5—Drainage and Transportation	2	..
Spanish 5	3	..
Electives	8	6
	20	18

Second Semester—	Lectures.	Lab.
Metallurgy 6—Non-ferrous Metals...	5	..
Metallurgy 10—Cyanide Testing....	..	12
Metallurgy 8—Electro-Metallurgy ..	2	..
Mining 6—Compressed Air	2	..
Spanish 6	3	..
Electives	8	6
	20	18

Graduate Year

Electives and Fifth Year Subjects:

Metallurgy 11—Advanced Metallurgy.
Metallurgy 12—Advanced Metallurgy.
Metallurgy 13—Metallography.
Metallurgy 16—Metallurgical Design.
Metallurgy 15 and 18—Thesis.
Mining 9-10—Mine Design.
Mining 13—Efficiency Engineering and Administration.
Mining 14—Safety Engineering and Hygiene.
Mining 16—Mining Law.
Mining and Metallurgical Reports.
Civil Engin. 31—Contracts and Specifications.
Economics 11, 12 or Sociology 11, 12.

Considerable latitude will be allowed in the selection of subjects in this year.

CIVIL ENGINEERING COURSE

Freshman Year

First Semester	Hours per Week Lectures.	Lab.
Chemistry 3—General and Qualitative	4	9
Civil Engin. 1—Mechanical Drawing.	..	6
English 9—Composition	4	..
Mathematics 7—Trigonometry	5	..
Shop 1—Woodwork	..	3
Modern Languages, Optional	3	..
	16	18

Second Semester—	Lectures.	Lab.
Chemistry 4—General and Qualitative	4	9
Civil Engin. 2—Mechanical Drawing.	..	6
English 10—Composition	4	..
Mathematics 8—Analytic Geometry	5	..
Shop 2—Woodwork	..	3
Modern Languages, Optional	3	..
	16	18

Sophomore Year

First Semester—	Hours per Week Lectures.	Lab.
Chemistry 5—Quantitative Analysis.	2	6
Civil Engin. 5—Surveying	3	3
Geology 1—General Geology	4	3
Mathematics 9—Calculus	5	..
Physics 3—General	4	3
Shop 3—Forge and Machine	..	3
Modern Languages, Optional	3	..
	21	18

Second Semester—	Lectures.	Lab.
Chemistry 6—Quantitative Analysis.	2	6
Civil Engin 6—Surveying	3	3
Geology 2—General Geology	4	3
Mathematics 10—Calculus	5	..

Physics 4—General	4	3
Shop 4—Forge and Machine	..	3
Modern Languages, Optional	3	..
	21	18

Junior Year

First Semester—	Hours per Week Lectures.	Lab.
Civil Engin. 3—Descriptive Geometry	1	3
Civil Engin. 7—Topographic Drawing	..	3
Civil Engin. 11—Graphical Statics	..	3
Civil Engin. 13—Railroad Engineering	1	3
Civil Engin. 15—Cement and Concrete	2	..
Metallurgy 1—General	3	..
Mining 1—Breaking Ground	3	..
Physics 5—Analytic Mechanics	4	..
Sociology 1 or Economics 1	3	..
Electives	2	6
	19	18

Second Semester—	Lectures.	Lab.
Civil Engin. 4—Descriptive Geometry	..	3
Civil Engin. 12—Graphical Statics	..	3
Civil Engin. 14—Mechanics of Materials	4	..
Civil Engin. 18—Stereotomy	..	3
Metallurgy 4—Iron and Steel	3	..
Mining 2—Tunnelling, Shaft Sinking.	2	..
Sociology 2 or Economics 2	3	..
Steam Engin. or Hydraulics	3	3
Electives	2	6
	17	18

Senior Year

First Semester—	Hours per Week Lectures.	Lab.
Civil Engin. 23—Roofs and Bridges.	3	6

Civil Engin. 25—Arches and Foundations, Dams and Retaining Walls	5	..
Civil Engin. 29—Roads and Pavements	3	..
Civil Engin. 31—Contracts and Specifications	1	..
Electrical Engin. 3	4	3
Electives	2	6
	18	15

Second Semester—	Lectures.	Lab.
Civil Engin. 16—Testing	1	6
Civil Engin. 24—Roofs and Bridges	3	6
Civil Engin. 30—Irrigation, Water Power and Supply	5	..
Civil Engin. 32—Framed Structures.	3	3
Steam Engin. or Hydraulics	3	3
Electives	3	..
	18	18

ELECTRICAL ENGINEERING COURSE

Freshman Year

	Hours per Week	
First Semester—	Lectures.	Lab.
Chemistry 3—General and Qualitative	4	9
Civil Engin. 1—Mechanical Drawing.	..	6
English 9—Composition	4	..
Mathematics 7—Trigonometry	5	..
Shop 1—Woodwork	..	3
Modern Languages, Optional	3	..
	16	18

Second Semester—	Lectures.	Lab.
Chemistry 4—General and Qualitative	4	9
Civil Engin. 2—Mechanical Drawing.	..	6
English 10—Composition	4	..
Mathematics 8—Analytic Geometry	5	..

Shop 2—Woodwork	..	3
Modern Languages, Optional	3	..
	16	18

Sophomore Year

First Semester—	Hours per Week Lectures.	Lab.
*Chemistry 5—Quantitative Analysis	2	6
Civil Engin. 5—Surveying	3	3
Geology 1—General Geology	4	3
Mathematics 9—Calculus	5	..
Physics 3—General	4	3
Shop 3—Forge and Machine	..	3
Modern Languages, Optional	3	..
	21	18

Second Semester—	Lectures.	Lab.
*Chemistry 6—Quantitative Analysis	2	6
Civil Engin. 6—Surveying	3	3
Geology 2—General Geology	4	3
Mathematics 10—Calculus	4	..
Physics 4—General	4	3
Shop 4—Forge and Machine	..	3
Modern Languages, Optional	3	..
	21	18

Junior Year

First Semester—	Hours per Week Lectures.	Lab.
Civil Engin. 11—Graphical Statics	..	3
Electrical Engin. 3—General	4	3
Electrical Engin. 5—Electrical Measurements	3	3
Physics 5—Analytic Mechanics	4	..
Sociology 1 or Economics 1	3	..
Electives	5	..
	19	9

Second Semester—	Lectures.	Lab.
Civil Engin. 12—Graphical Statics	..	3
Civil Engin. 14—Mechanics of Materials	4	..
Electrical Engin. 4—A. C. Theory	4	3
Sociology 2 or Economics 2	3	..
Steam Engin. or Hydraulics	3	3
Electives	5	3
	19	12

Senior Year

First Semester—	Hours per Week Lectures.	Lab.
Civil Engin. 31—Specifications and Contracts	1	..
Electrical Engin. 7—Advanced A. C. Theory	4	3
Electrical Engin. 9—Meters and Control Apparatus	4	3
Electrical Engin. 11—Light and Illumination	3	..
Electrical Engin. 13—Electrical Design	..	6
Electives	6	..
	18	12

Second Semester—	Lectures.	Lab.
Electrical Engin. 8—Transmission Lines and Distribution	4	3
Electrical Engin. 10.—Generating Plants and Substations	4	..
Electrical Engin. 12—Electrical Machinery	3	3
Electrical Engin. 14—Electrical Design	..	6

Steam Engin. or Hydraulics	3	3
Electives	4	..
	18	15

*Students in Electrical Engineering may substitute some course in electrical work for this Chemistry.

CHEMISTRY

Professor Bisson. Assistant Professor.....

The courses in Chemistry are designed to give engineering students a knowledge of the principles of Chemistry most essential to their work. The subject is presented in all courses according to the modern chemical theories. The purpose is to create an interest in experimentation and to teach the proper classification of experimental data according to the general principles studied, as well as to develop accuracy and precision in manipulation.

Chemistry 1-2

Inorganic Chemistry: The work in this course consists of demonstrated lectures and laboratory exercises dealing with the common elements and the compounds which they form, and is arranged for students who do not present entrance credit in a good high school course in Chemistry, and who desire to continue further work in Chemistry.

First and Second Semesters: Three lecture periods and six laboratory hours per week.

Text Book: Brownlee, Principles of Chemistry Brownlee, Laboratory Exercises in Chemistry.

Chemistry 3-4

General and Qualitative Chemistry: This course begins with a careful study of the fundamental theories and laws of Chemistry which are necessary for a thorough understanding of the procedures in Qualitative and Quantitative analy-

sis. The laboratory work is closely correlated with the lectures. Experiments illustrating the gas laws, stoichiometric relations in chemical reactions, chemical equilibrium, oxidizing and reducing agents, ionization, etc., are performed. This work gradually leads into the subject of Qualitative analysis and this begins with an outline of the general scheme of analysis for the basic and acidic constituents. Emphasis is placed upon the general principles of chemistry involved in every step in the separation and identification of the elements. The detection and identification of a number of the rarer elements is included in the work of this course.

Freshman Year, First and Second Semesters: Four lecture periods and nine laboratory hours per week.

Prerequisite: Chemistry 1-2 or 1 year of high school Chemistry.

Text: Hildebrand, Principles of Chemistry; Bray and Rosensten, Laboratory Manual of General Chemistry; A. A. Noyes, Qualitative Analysis; A. Smith, Inorganic Chemistry.

Chemistry 5-6

Quantitative Analysis: The work in this course covers the general principles of quantitative analysis, and includes the analysis of simple substances by both gravimetric and volumetric methods. The procedures studied during the first semester are entirely gravimetric processes while those of the second semester are volumetric processes. The theory and facts upon which the experimental work is based are discussed and a number of problems in chemical calculation are solved.

Sophomore Year, First and Second Semesters: Two lecture periods and six laboratory hours per week.

Pre-requisite: Chemistry 3 and 4.

Text: Blasdale, Principles of Quantitative Analysis.

Chemistry 7

Advanced Quantitative Analysis (Metallurgical Chemistry): This course is a continuation of the work in Chemistry 5 and 6 and includes a study of the practical analytical methods used in Metallurgical industries for the analysis of ores, alloys, furnace products, etc., and for the analysis of the rare elements found in the minerals of the Black Hills. Reference is made to the analytical methods described in the Chemical Journals as well as to those presented in the standard texts.

Junior Year, First Semeter: Two lecture periods and nine laboratory hours per week.

Prerequisite: Chemistry 5-6.

Text: Lord and Demorest, Metallurgical Chemical Analysis. Reference Text, Scott, Standard Methods of Chemical Analysis.

Chemistry 9-10

Physical Chemistry: In this course the more important principles of physical chemistry are studied from the standpoint of their application to problems of the chemist and metallurgist. The lectures are supplemented with problem work.

Junior or Senior Year, (elective), First and Second Semesters: Two lecture periods per week.

Prerequisite: Chemistry 5-6. Physics 3-4, Mathematics 9-10.

Text: Washburn, Principles of Physical Chemistry.

Chemistry 11

Electro Chemistry: Theoretical and Applied.

Senior Year, First Semester: Two lecture periods per week.

Prerequisites: Chemistry 5-6, Physics 3-4, Mathematics 9-10.

Text: LeBlanc, Electro Chemistry.

Chemistry 100

Chemical Research: Opportunity will be given for original research along chemical lines, to students qualified to undertake such work.

GEOLOGY AND MINERALOGY

Professor O'Harra. Professor Connolly.

Library, Laboratory and Field Facilities

A good, well equipped departmental library is placed convenient to the lecture and laboratory rooms and students are required to make intelligent use of the literature contained therein.

The laboratory equipment and the museum collections, elsewhere described, furnish indispensable material for practical work of many kinds.

Field facilities are unsurpassed. Unusual opportunity is offered for study in the field of the various geological horizons, including important and valuable economic deposits. Within a few miles of the school the student may observe upturned strata of nearly all geological ages. Twenty miles southwest of Rapid City is the Harney Peak granite area, with its lavish variety of mineral specimens. Surrounding this is a wonderful exposure of Algonkian metamorphic rocks cut in many places by auriferous quartz veins. The Cambrian, Carboniferous, Triassic, Jurassic, and Cretaceous are extensively developed. The famous White River Badlands of Tertiary age lie to the southeast of the Hills and afford fossils which have made the region known whenever the science of Paleontology is taught. In the northern part of the Hills important igneous rocks, such as rhyolite, phonolite, andesite, dacite, etc., occur in the form of dikes, sheets and laccoliths. Closely associated with these in slates, quartzites, and limestones, gold ores of the greatest importance are found.

In the autumn, short field excursions are made by the class to nearby points of interest and occasionally a visit of several days is made to more distant localities. Thus the student, in addition to lecture and laboratory instruction, has the advantage of systematically directed field study and with the information thus gained, he should be able to undertake for himself the working out of practical field problems.

Geology 1-2

General Geology: This course is arranged primarily as introductory to all work in geology and mineralogy. It extends throughout the Freshman year and embraces a comprehensive study of the fundamental principles of geology. The course includes brief, but careful study of dynamical, stratigraphical, structural, chemical and historical geology, and is conducted by means of lectures, text books, and laboratory work, and frequent excursions to points of particular interest. Under dynamic geology, the atmospheric, aqueous, igneous, and organic agencies are discussed with reference to their bearing on the present and past condition of the earth's surface. Stratigraphical and structural geology consider the conditions of deposition of sediments and of the disturbance of rock masses. A portion of the time allotted to these subjects is devoted to the study of such minerals and rocks as enter largely into the structure of the earth's surface; also to the methods of geological surveying, including mapping, section making, special problems. Chemical geology includes the study of the general relation which chemistry bears to geological phenomena, such as the formation, metamorphism, and degeneration of rocks, and the origin and alterations of the various kinds of mineral deposits. Under historical geology, the physical history of the earth is discussed, the classification and distribution of sedimentary rocks studied, and the

methods of correlation explained. The course aims to equip the student with useful information concerning the phenomena and history of the earth, so that he may know the methods used in geological research, and will better understand how to interpret facts gained in the study of economic deposits.

Sophomore Year, First and Second Semesters: Four lecture periods and three laboratory hours per week.

Text Book: Pirsson's Text-book of Geology. Miller's Introduction to Historical Geology. Tarr's Tables for the Determination of the Common Minerals and Rocks.

Prerequisites: Preparatory physics and chemistry.

Mineralogy 1 and 2

This course runs throughout the year. Eight weeks of the first semester are given to the study of symmetry, forms, and classification of crystals. In the laboratory the student becomes familiar with the various types of crystals through the study of models, and later is required to identify the forms of one hundred mineral crystals.

The remainder of the semester and most of the second semester are devoted to general and determinative mineralogy. During the lecture hours the composition, forms, properties, occurrence, origin, associations, and uses of about two hundred mineral species are studied, special attention being given to ore and common rock-forming minerals. In the laboratory the methods of blowpipe and other chemical analysis for the determination of minerals are reviewed, after which the student is required to determine several hundred unlabeled specimens of minerals by means of physical properties and chemical tests. Although the student becomes familiar with the methods and technique of blowpipe analysis he is encouraged to identify minerals by physical properties alone,

where that is posible, in order to develop such information as may be needed for the quick and accurate determination of minerals in the field.

During the last few weeks of the second semester a short practical study of the more common rocks is taken up, based upon Professor Pirsson's admirable text.

The lectures and laboratory work are supplemented by occasional field trips.

Junior Year: Two lecture periods and six laboratory hours per week.

Texts: Dana-Ford Manual of Mineralogy; Lewis' Determinative Mineralogy.

Pre-requisites: Geology 1 and 2, Chemistry 3 and 4.

Geology 3-4

Economic Geology: This course runs throughout the Senior year and includes study of the origin, modes of occurrence and uses of economic mineral products. About one-half of the first semester is given to the study of non-metallic products. This includes the origin, nature, relations and values of coal, petroleum, natural gas, salines, building stone, clays, cement materials, fertilizers, abrasives, gems, etc. The rest of the course is devoted to the study of metallic products, such as gold, silver, copper, iron, lead, zinc, platinum, mercury, nickel. In this much attention is given to the study of the principles of ore deposition and to the historical development of the theories connected therewith. Careful attention is given to the chief types of deposits and particularly to localities noted for their wealth of output.

Maps, specimens, and original papers are freely used. The necessity of individual examination by the student of the best up-to-date literature is insisted upon, and a reasonable ability to properly use such literature is required. Much attention is devoted to the study of the many economic interests

of the Black Hills region and observation of the deposits in the field is encouraged.

During the later part of the course the student is introduced to the science of Mineragraphy, or the application of the metallographic microscope to the study of ore minerals in polished section. This recently developed science has assumed an important place in the study of ore deposits, and is an essential part of the equipment of the well trained mining engineer and mining geologist. Students make a number of polished sections themselves, and learn the methods of identification of the opaque minerals under the reflecting microscope, and the interpretation of the structures observed.

Senior Year, First and Second Semesters Four lecture periods per week.

Reference Texts: Beck-Weed's Nature of Ore Deposits; Ries' Economic Geology; Kemp's Ore Deposits of the United States and Canada; Lindgren's Minerals Deposits; Beyschlag, Vogt, and Krusch's Ore Deposits; Murdoch's Microscopical Determination of the Opaque Minerals; Emmonds' Principles of Economic Geology.

Prerequisites: Mineralogy 1 and 2.

Geology 5

Optical Mineralogy: This course is mainly introductory to the study of Petrography. It aims to enable the student to recognize the common minerals by means of the microscope. A discussion of the principles and phenomena of light, such as reflection, refraction, interference is offered and the different media and their wave fronts, optical signs and indicatrices receive special attention. This is succeeded by an application of these laws to the movement of light in different crystals, and the use of the petrographic microscope in the identification of minerals in thin sections. For laboratory work excellent Zeiss and Leitz microscopes are available.

The fairly extensive collection of thin sections includes a special set of 120 oriented mineral sections manufactured by Krantz.

Petrography: This course is intended for mining students who need some training in rock determination, but who have opportunity to devote only a short time to the subject. It embraces the study of rocks, both under the microscope and in hand specimens. The lectures are devoted to a general discussion of the principles of rock classification, special attention being given to the system of Kirkel and Rosenbusch modified as in use in America, which is followed by a brief summary of the Quantitative system. The origin, distribution, mode of occurrence and relations of rock masses and contact metamorphism are included. The principles of regional metamorphism and a classification of metamorphic rocks follow. For the laboratory work a Kranz collection of 350 rocks and thin sections is available. In addition, there is a fairly complete collecton of Black Hills rocks, most of which are thin sectioned. There is also a set of unlabeled rocks with accompanying thin sections representing all common types, which are used for description and study by the student.

The Black Hills offer an exceedingly interesting field for the petrographer on account of the great variety of rock types within their small area. When possible field excursions will be taken to points of interest, especially to the metamorphic and igneous areas.

First Semester: Three lecture periods and four and one-half laboratory hours per week.

Reference books: Manual of Petrographic Methods, Johannsen. Determination of Rock Forming Minerals, Johannsen. Rock Minerals, Iddings. Igneous Rocks, Iddings. Igneous Rocks and Their Origin, Daly. The Natural History of Igneous

Rocks, Harker. Petrology for Students, Harker. Lecture Notes.

Prerequisites: Mineralogy 1 and 2, Physics 4.

Geology 6

Structural Geology: The course begins with a resume of the different hypotheses of earth origin and those concerning the interior condition of the earth. Vulcanism in its broader aspects, its causes and manifestations is next taken up and this is followed by a brief summary of the modern ideas on diastrophism and isostasy. Rock fractures, flowage, faults and folds are discussed in their relations to deformative stresses and the major units of earth structure in their proper relations. Special attention is given to the solution of problems in faulting and folding that have a bearing on the practical work of the miner.

Second Semester: Three lecture periods per week.

Reference Texts: Leith's Structural Geology. Leith & Mead's Metamorphic Geology. Lahee's Field Geology.

Pre-requisites: Mineralogy 1 and 2.

Research

Properly qualified students will be given opportunity to do original research work, or take up advanced studies in geology, mineralogy, petrography, or economic geology.

MATHEMATICS

Professor McLaury.

The engineer, from the very nature of his work, must of necessity meet many difficult problems. His success will depend on his ability to solve them. As it is impossible to tell in advance just what experience a given student will meet, that course is best which results in mental power. It is not a question of what the student has done, but what he

can do. Has he a comprehensive grasp of the subject; has he thoroughly mastered the principles; can he apply these principles to kindred subjects?

The aim of this department will be to give the student a thorough knowledge of the principles of mathematics so as to enable him to apply them readily to the solution of practical problems. Original work is encouraged, and an effort is made to cultivate the habit of exact, logical reasoning, and to stimulate independent thought. Both rapidity and accuracy are expected in all mathematical work. The great importance of mathematics as the basis of a scientific education justifies the requirement of all elementary courses, as a prerequisite to the engineering courses.

In the following courses, particular pains will be taken to explain all the more difficult algebraic processes as they occur. Several subjects in higher algebra will be discussed, each at the point where it is required for immediate application. Students who have not studied algebra for a year or more, should make a careful review before entering school, for a thorough knowledge of the elements of algebra is essential to the successful completion of all subsequent courses. All students who have had less than two years of algebra should continue algebra with their Freshman work. To this end there is arrangement by which one may take algebra two lecture periods per week during the first and second semesters.

Mathematics 7

Trigonometry: Plane, analytical and spherical. Considerable attention is paid to the consistent and scientific development of the fundamental conventions and definitions, and to the derivation and transformation of trigonometric expressions. Many practical problems are solved.

Freshman Year, First Semester: Five lecture periods per week.

Text Book: Phillips & Strong's Trigonometry.

Mathematics 8

Analytic Geometry: This course includes the following subjects: Loci, straight lines, transformation of co-ordinates; circles; conic sections; the general equation of the second degree and higher plane curves.

The theory will be developed by lectures.

Freshman Year, Second Semester: Five lecture periods per week.

Text Book: Nichol's Analytic Geometry.

Mathematics 9

Differential Calculus: The text book work is supplemented by lectures. This course will include a short course in solid analytic geometry, based on Nichol's Analytic Geometry.

Sophomore Year, First Semester: Five lecture periods per week.

Text Book: Granville, Differential and Integral Calculus.

Mathematics 10

Differential and Integral Calculus: This course is a continuation of the last course and will include the most of the work in Granville's Calculus.

Sophomore Year, Second Semester: Five lecture periods per week.

Mathematics 11

Differential Equations: Three lecture periods per week.

Text Book: Differential Equations by D. A. Murray.

METALLURGY

Professor Traphagen.

Metallurgical subjects are taught by lecture courses with frequent reference to standard works on the subject, and to the current literature.

The lectures are supplemented, as far as possible, by laboratory work and experiments, and by excursions to neighboring metallurgical works. The school is favorably situated in being contiguous to an active gold mining district, the Black Hills, affording excellent opportunity to study the practical side of metallurgy, particularly that of gold, on a large scale and at close range. The stamp mills and cyanide plants of Lawrence county are easily reached by rail in two hours' time.

A well equipped metallurgical laboratory is available for use, and it is desirable that the student should be thoroughly trained in the basic scientific principles of metallurgy. With actual metallurgical operations, on a large scale, the student becomes familiar to such an extent as is desirable during his school years, by visits to the working plants of the district.

In the laboratory he becomes acquainted with the use of pyrometers, calorimeters, microscopes for the examination of metals and furnace products and other scientific metallurgical apparatus. He conducts experiments in the refining and heat treatment of steel, electric deposition of metals, formation of slags, refining of metals, cyanide process and amalgamation, etc. He becomes experienced to some extent with actual working of a furance, stamp mill, concentrating tables and cyanide plant with which the laboratory is provided.

The department is equipped with a card index of metallurgical literature, which covers all of the subjects of interest, and is at the service of students.

Metallurgy 1

Introductory Metallurgy: This course consists of lectures on the physical properties of metals; on alloys, their types, nature and properties; fuels; combustion; refractory materials, thermal measurements; discussions of metallurgical principles,

slags and furnace products and their nature; types of furnaces and furnace construction; the means of supplying and heating blasts; thermo-chemistry, including a discussion of chemistry at high temperatures; typical metallurgical processes and the general economic considerations of metallurgy, such as buying and selling ores and metallurgical products. Students are required to do outside reading from references given in the class room and hand in for examination papers on topics assigned. Laboratory work covering part of this course is carried out in the Senior Year, and is described under Metallurgy 11.

Junior Year, First Semester: Three lecture periods per week.

Text Book: Hofman, General Metallurgy.

Metallurgy 2

Assaying: This course is taught by lectures and by laboratory work, based on the lectures. Elementary chemistry, qualitative and quantitative analysis are prerequisites, being necessary for a thorough understanding of the work.

The work of the laboratory includes assaying of reagents, the testing of ores to discover their nature; the study of oxidizing and reducing reactions occurring in assaying; the study of typical assay slags; the assaying of pure gold and silver ores by crucible and scorification methods; the special assaying of copper and zinc ores containing gold and silver; the assaying of arsenical and antimonial ores for gold and silver; the study of cupellation and the factors which influence its results; the assaying of impure ores by the roasting, the nitre, iron nail and excess litharge methods; the assaying of telluride ores, lead bullion, cyanide solutions and precipitates for gold and silver; the assaying of gold and silver bullion; the assaying of ores and alloys for platinum, iridium, etc.; the assaying of

lead and tin ores, and the assaying of furnace products.

Junior Year, Second Semester: Two lecture periods and nine laboratory hours per week.

Text Book: Traphagen; Lecture Notes.

Metallurgy 3

The Metallurgy of Gold and Silver: This course consists of lectures on the metallurgy of gold-silver, taking up first, modern stamp mill practice, discussing in detail mortar boxes, stamps, screens, general battery construction, etc., and the influence of weight of stamp, screen mesh, mortar box dimensions, amount of water, on results obtained. Inside and outside amalgamation is studied in detail; the general mill arrangements; clean up; the influences of other processes following amalgamation; modern fine grinding in tube mills and other apparatus. This is followed by a discussion of the cyanide process for gold and silver ores; wet and dry crushing; crushing in cyanide solution; the separation of sands from slimes; the treatment of sands by percolation; the treatment of slimes by decantation, filter pressing and vacuum filtration; the precipitation of gold and silver by the various methods in use, methods of cleaning up, and the smelting of cyanide precipitates. The general chemistry of cyanidation is discussed, also the chloridizing process for silver ores, etc.

Senior Year, First Semester: Two lecture periods per week. Lecture notes.

Reference Works: Julian & Smart, Cyaniding of Gold and Silver Ores; Henry Louis, Handbook of Gold Mining; T. K. Rose, Metallurgy of Gold; Del Mar, Stamp Milling; McFarren, Cyanide Practice; Clennel, The Cyanide Handbook; Thomson, Stamp Milling and Cyaniding.

Metallurgy 4

Iron and Steel: This course consist of lectures on iron alloys, their classification, structure, prop-

erties, metallography, taking up more particularly iron and steel. The hardening and tempering of steel receive special attention. The metallurgy of cast iron, wrought iron and steel is discussed in principle, but not in great detail. Especial attention is paid to the principles and chemistry of the iron blast furnice to the Acid Bessemer process, and to the Acid and Basic Open Hearth processes. Statistics of the iron and steel industry are given. The student is required to do considerable outside reading.

Junior Year, for Metallurgical Students, Senior Year for Mining Students, Second Semester: Three lecture periods per week. Lecture notes.

Text: Stoughton, Metallurgy of Iron and Steel.

Metallurgy 5

The Metallurgy of Copper: This course consists of lectures on the modern metallurgy of copper. It includes the types of copper ores and the methods suitable for the treatment of the different types. The principles of the blast furnace, and reverberatory processes for copper are discussed in detail, as they bring out clearly the chemistry of copper. Matte smelting for copper ores is studied, both pyrite smelting and ordinary matte smelting receiving careful attention; also the roasting of copper ores and calculation of charges. This is followed by the discussion of the Bessemerizing of copper mattes and the electrolytic refining of blister copper. In addition to this the wet method for copper ores are described.

Senior Year, First Semester: Three lecture periods per week.

Reference Works: Peters, Practice of Copper Smelting; Schnabel, Handbook of Metallurgy; Peters, Principles of Copper Smelting.

Metallurgy 6

Non-ferrous Metals: This course takes up the consideration of metals not covered in other courses. Lead, zinc, tin, mercury, nickel and various other metals are here studied and special emphasis is placed on the principles underlying practice and the handling of complex ore mixtures.

Senior Year, Second Semester: Five lecture periods per week.

Metallurgy 7

Pyrometry and Special Problems: Laboratory practice in phyrometry; calibration of the thermocouple with the use of potentiometer; the roasting of ores, noting the formation of sulphate, etc.; the desilverization of base bullion by the Parkes process. Special problems according to the requirements of individual students.

Senior Year, First Semester: Six laboratory hours per week for Mining Students; twelve laboratory hours per week for Metallurgical Students.

Metallurgy 8

Electro-Metallurgy: Electrolytic processes applied to recovery of metals and refining of products. Aqueous and fused electrolytes. Electro thermic process, including a study of furnaces and the production and refining of metals.

Senior Year, Second Semester: Two lecture periods per week.

Metallurgy 10

Cyanide Testing: Testing of ores for the cyanide process. The student will have thorough training in the testing of ores for the purpose of ascertaining the best methods of treatment of a given ore. The data obtained will be used in the work in the drafting room in the course in Metallurgical Design.

Senior Year, Second Semester: Six laboratory hours per week for Mining Students; twelve laboratory hours per week for Metallurgical Students.

Metallurgy 11 and 12

Advanced Metallurgy: A course of lectures and seminar work based on previous work in this course. It involves a critical study of different operations with comparisons and a balancing of apparent advantages and disadvantages, a consideration of processes not previously studied and reviews of current articles on various phases of metallurgy.

Fifth Year, First and Second Semesters: Three lecture periods per week.

Metallurgy 13

Metallography: A lecture and laboratory course, taking up the study of alloys and various metallurgical products, special attention being given to iron and steel.

Fifth Year, First Semester: Two lecture periods and six laboratory hours per week.

Metallurgy 14

Metallurgical Laboratory: One unbroken week spent in the metallurgical laboratory on work assigned by the department.

Senior Year, Second Semester: Forty-eight hours.

Metallurgy 16

Metallurgical Design: This work will be closely related to the thesis subject and will cover the design of a plant suitable for the treatment of a given tonnage of the ore studied in the thesis.

Fifth Year, Second Semester: Six laboratory hours per week.

Metallurgy 15 and 18

Thesis: An ore selected by the Department will be assigned for special study and the best method for its treatment will be determined by experiment. In general, an ore which presents a real problem will be used and it is expected that a large amount of experimental work will be required for its solution.

Fifth Year, First and Second Semesters: Six laboratory hours per week.

Metallurgical Engineer

This advanced degree will be given to students who satisfactorily complete the fifth year of the metallurgical course which provides for a number of electives in addition to the advanced subjects in metallurgy. A minimum of fifteen lecture hours per week, or the equivalent, will be required. Provision is made for granting the degree also to graduates of the school, who have not completed the Fifth Year but who have shown capability and accomplishment in the active practice of their profession. The general requirements are given elsewhere, and the detailed arrangements are in charge of the Thesis Committee.

MINING

Professor Bochert.

The instruction in Mining is given by lecture courses, illustrated by lantern views, photographs and drawings; by frequent reference to standard works and current literature; by experimental work on various types of ores, carried on in the mining laboratory, and by excursions to nearby mines and mills for the purpose of observing and noting actual conditions of practice.

The department enjoys to an unusual degree, those advantages which naturally accrue from the school's location. Being contiguous to a world famous mineral region, the nearness of large producing mines means much, while the wholesome mining atmosphere in which the student lives, furnishes a never failing supply of food for enthusiasm and interest.

The mining and metallurgical laboratory of the school, which has proven a most valuable adjunct to the work of instruction, is fully equipped with mod-

ern applicances of approved design. The operations attendant upon the preliminary treatment of various types of ore are here carried out by the students on a scale approaching commercial practice.

Special field work in mining is held each year in April. A suitable mining locality having been selected, students under the direction of instructors devote one week to the study of practical mining, both above and below ground, systematic note taking and careful sketching of all principal features being a requirement. Attendance upon this work is obligatory with all members of the Senior class.

The uniform courtesy and good will shown by the management of mining enterprises throughout the region to instructors and students indicates a wholesome regard for the efforts of the department and constitutes one of its most valuable assets.

The following courses are offered by the department:

Mining 1

Boring: The use of the earth auger, drive pipe, etc., in the boring of holes for wells and for prospecting purposes; the boring of deep holes by the churn drill and drop tool, also the diamond and other rotary drills; the survey of bore holes; the cost of boring.

Breaking Ground: The excavation of earth and rock in general; hand tools; mechanical earth excavators; rock drills and their use; channelers; coal cutters, steam shovel; dredges, etc.; estimates and costs.

Explosives: Black powder, nitro-glycerine, gun cotton and their derivatives; methods of testing the force of explosion and heat developed; pointing and charging of holes; methods of firing; cost of blasting operations.

Junior Year, First Semester: Three lecture periods per week.

Mining 2

Tunnelling: The driving of mine tunnels and drifts through rocks and through soft or running ground; comparative costs, general discussion of the methods used in driving large tunnels for railroad and other purposes.

Shaft Sinking: The sinking of shafts for mining purposes through soil, rock, quicksand and other water-bearing strata, by approved methods; costs of same.

Junior Year, Second Semester: Two lecture periods per week.

Mining 3-4

Ore Dressing: The principles of ore crushing with description of the various types of crushing machinery; screens and the principles of screen sizing; stamp milling and amalgamation; the theory and practical application of the dressing of ores by water currents, including description of the principal forms of classifiers; jigs and the laws of jigging; concentrating tables; slime treatment and the machinery for its accomplishment; magnetic concentration; concentration by oil; dry concentration; general discussion of the continental and English systems of ore dressing and their American modifications; the description and study of typical ore dressing plants.

Junior Year, First and Second Semesters: Three lecture periods and three laboratory hours per week.

Mining 5

Drainage: Sources of mine water; dams and drainage levels; hoisting of water; Cornish and direct acting pumps; centrifugal pumps; use of compressed air and electricity in pumping operations; special examples and costs.

Transportation: Underground and surface haulage; vehicles and motive power; self-acting and engine planes; tail rope and endless rope systems

of haulage; electric and pneumatic haulage; surface tramways and aerial ropeways.

Senior Year, First Semester: Two lecture periods per week.

Mining 6

Compressed Air and Its Uses: The modern air compressor with accessories and the laws under which it operates; conveyance of compresed air in pipes; effect of altitude; air compression by the direct action of falling water; calculations; costs.

Senior Year, Second Semester: Two lecture periods per week.

Mining 7

Exploitation: The extraction of mineral by open works, by wells and bore holes; the underground working of veins, bedded deposits and masses by methods best suited to each; conditions affecting the choice of methods; cost of ore extraction.

Supporting Excavations: The use of wood, metal and masonry in the lining of shafts and other excavations, their relative cost, strength and durability; the timbering of stopes, stations and other working places underground; the preservation of timber.

Hoisting: Hoisting engines, their construction and chief features; methods of equalizing the load moment on the engine; ropes, cages, skips and safety applicances; gallows frames, pneumatic hoisting; costs.

Senior Year, First Semester: Three lecture periods per week.

Mining 8

Ventilation: Natural and induced ventilation; furnaces and fans; friction of air in mines; control of air currents; efficiency of ventilating apparatus.

Lighting: Open lights, safety lamps, the electric and other lights used in underground illumination.

Placer Mining: Sluices, riffles, pipe lines, nozzles and hydraulic elevators, their construction and use; river dredging, costs and results.

Senior Year, Second Semester: Three lecture periods per week.

Mining 9-10

Design of Mining Plant: The student is given certain data relative to a hypothetical mine, such as maximum depth of hoist, capacity of hoisting, etc., from which he calculates the power needed, selects the type and size of hoisting engine, makes calculations as to the size of reel for flat rope, and drums of different forms, such as to give the best results in the equalization of moment on the engine. He then calculates and designs the gallows frame and shaft house, also other features such as ore bin, mine cage, car or skip.

Senior Year, First and Second Semesters: Six laboratory hours per week.

Mining 12

Mine Examination: Principles underlying Mine Sampling. Implements used and general methods of sampling. Precautions necessary in the handling and preparation of samples. Estimation of "Ore in Sight." Methods of calculating values, tonnage, and costs of production; Forms of Report.

Two hours per week, Second Semester.

Mining 13

Efficiency Engineering and Administration: Business management as applied to mining, milling and metallurgical plants. General methods of business, organization of staff, relations between workers and management, standardizing operations and working conditions, buying and selling ores, purchasing supplies and general store-room methods.

Accounting: Organization of corporations and stock companies with particular reference to mining and metallurgical companies, discussion of the gen-

eral principles of book-keeping and accounting; classification of costs, and cost finding methods.

Three hours per week, First Semester.

Mining 14

Safety Engineering and Hygiene: Accidents, their causes and prevention, sanitation and health conditions in and about mines, mills and metallurgical plants. Practical instruction will be given in First Aid to the Injured and Mine Rescue Work. Mine fires and explosions are discussed as to their origin, methods of fighting and precautions necessary for their prevention.

Three hours per week, Second Semester.

Engineer of Mines

This advanced degree will be given to students who satisfactorily complete the fifth year of the mining course which provides for a number of electives in addition to the advanced subjects in mining. A minimum of fifteen lecture hours per week, or the equivalent, will be required. Provision is made for granting the degree also to graduates of the school who have not completed the fifth year but who have shown capability and accomplishment in the active practice of their profession. The general requirements are given elsewhere, and the detailed arrangements are in charge of the Thesis Committee.

CIVIL ENGINEERING

Professor Hathaway.

The aim of this department is to give the student such training in the class room, drawing room, laboratory and field as will properly fit him for entrance to an engineering career.

The endeavor will be to give him enough practical knowledge to enable him on graduation to fill with credit a subordinate professional position and to teach him so much of the underlying theory and

principles as to permit him when he has clothed these with experience of his own to rise to the higher ranks of his calling.

The department occupies two well lighted drawing rooms, 24x34 and 24x30 feet in size, lecture rooms and offices. The drawing rooms are furnished with suitable drawing desks which have separate lockers for each student.

The work of this department extends over a period of four years and includes the following courses:

Civil Engineering 1-2

Mechanical Drawing: Practical work in the drawing room accompanied by lectures as needed. The work is carried on chiefly by means of individual instruction. The course includes the care and use of instruments; the mounting of sheets; simple geometric constructions; orthographic, isometric and cabinet projection, machine details, and both freehand and mechanical lettering of titles. Tracing and blue printing are taught in this course.

Students taking this course should provide themselves with the following list of supplies, most of which may be obtained from the supply room of the department at cost:

One set of drawing instruments containing:
One pair 6-in. compasses, with pen, pencil and needle points.
One pair 6-in. dividers.
One 5½-in. ruling pen.
One 3½-in. steel spring bow divider.
One 3½-in steel spring bow pencil.
One 3½-in. steel spring bow pen.
One T square with 30-in. blade.
One 4½-in. protractor.
One irregular curve.
One 7-in. 30° by 60° triangle.
One 8-in. 45° triangle.

Drawing paper, pencils, ink, erasers, etc., may be purchased from the department at cost.

French's Engineering Drawing is used as a text book.

Drawing boards and key for locker are furnished by the school on the payment of a fee of $1 per year; 50 cents of this is refunded on return of key and board.

Freshman Year, First and Second Semesters: Six laboratory hours per week.

Civil Engineering 3-4

Descriptive Geometry: This work includes the projection of the point and the line and the representation of planes, with numerous problems relating thereto, and the generation, classification and intersection of curves and surfaces. Drafting room work with individual talks.

Junior Year, First Semester: One lecture and three laboratory hours per week; second semester, three laboratory hours per week.

Text Book: Descriptive Geometry, Ames & Wischmeyer.

Civil Engineering 5-6

Surveying. Plane Surveying: It is the desire of the department to bring, as far as it is practicable, theory and practice side by side. Ample opportunity for field work is provided and the institution is provided with all the instruments and accessories necessary to carry on the work. Additional instruments are purchased as the need for them arises.

For the performance of the field work, the class is divided into squads with just sufficient number in each party to properly carry on the operations. Each student is required to take his turn at every part of the work; to use each instrument as the occasion demands; to make his notes and computations; and finally to accurately plot them in the drawing room.

The course outlined is as follows: Linear measurements by means of pacing and chain or tape, adjustment and use of the engineer's transit and level; traversing; principles of land surveying; adjustments and use of the plane table; adjustment and use of the solar instrument topographic surveying, determination of the meridian by means of the solar instrument; direct solar observation and observation on Polaris; measurements of volumes. Railroad surveying and city surveying will receive as much time as the conditions will permit. Trigonometry is a prerequisite.

Mine Surveying: This covers the location and patent survey of mineral claims; carrying the meridian underground via vertical and inclined shafts; underground traversing and leveling; underground connections; measurements of ore reserves and stopevolumes; note taking and plotting.

Sophomore Year, First and Second Semesters: Three lecture periods and three hours field work per week.

Text Book: Durhams' Mine Surveying.

A three weeks' summer school for practical work immediately follows the close of school in June. This includes two weeks of plane surveying and one week of mine surveying underground.

Text Book: Tracy's Plane Surveying.

Civil Engineering 7

Topographic Drawing: This work embraces the accurate drawing of maps, including topographic features, and the plotting of profiles. Many of the notes taken in the preceding summer's field work are thus worked up in the drafting room.

Prerequisite Civil Engineering 5-6.

Junior Year, First Semester: Three laboratory hours per week.

Civil Engineering 9

Machine Design: The drawing of screw threads, keys, fastenings, the various forms of gear

teeth, bevel gears, bearings, cams, quick return motions, etc. It is designed to make this course eminently practical, an introduction to those problems which continually meet the designing engineer and which the principles of machine design alone will help him to solve. Drafting room work with talks as needed and library references.

Junior Year, First Semester: One lecture and three laboratory hours per week.

Civil Engineering 11-12

Graphical Statics: The object of this course is to give an understanding of the theory of the graphical solution of internal stresses in a framed structure, arising from steady and moving loads, from the pressure of the wind, etc. The student is required to determine by graphical methods on the drawing board, the nature and amounts of internal stresses in the various members of such simple roof and bridge trusses and head frames as are assigned him.

Junior Year, First and Second Semesters: Three laboratory hours per week.

Text Book: Malcolm's Graphic Statics.

Civil Engineering 13

Railroad Engineering: The organization of a railroad company, the permanent way, rails, ties, roadbed, ballast, bridges, culverts, yards, elevation of outer rail, signals, locomotives, curves and grade problems, surveying for location and construction. Plane surveying is a prerequisite. Raymond's Elements of Railroad Engineering is used.

Junior Year, First Semester, Civil Engineering Course: One lecture period and three laboratory hours per week.

Civil Engineering 14

Mechanics of Materials: The resistance and elasticity of the materials of engineering; fundamental assumptions of the common theory of beams; distribution of stresses in beams; shearing

forces, bending moments, and deflections of beams; the theory of torsion, flexure, elastic limits; working stresses and ultimate stresses and ultimate resistance of cast iron, wrought iron, steel and timber; pipes and riveted joints; posts and columns; the design of posts, beams, shafts, etc.

Junior Year, Second Semester: Four lecture periods per week.

Text Book: Boyd's Strength of Materials.

Civil Engineering 15

Cement and Concrete: The composition, manufacture and use of Portland and natural cements, the mixing and placing of plain and reinforced concrete, the theory and calculation of reinforced concrete.

Junior Year, First Semester, Civil Engineering Course. Two lecture periods per week.

Civil Engineering 16

Testing Materials: A laboratory course with explanatory lectures. Must be accompanied or preceded by Civil Engineering 14.

Senior Year, Second Semester, Civil Engineering Course: One lecture period and six laboratory hours per week.

Civil Engineering 18

Sterotomy: Drafting room work with lectures as needed. Descriptive geometry applied to the detail drawing of masonry arches and other structures with plane, curved or warped surfaces. The drawing room courses of the first two years are prerequisites.

Junior Year, Second Semester, Civil Engineering Course. Three laboratory hours per week.

Civil Engineering 23-24

Roofs and Bridges: A study of the usual designs of roof and bridge trusses, with calculations of stresses and drawing room work in design. Must be preceded by Civil Engineering 11-12.

Senior Year, Civil Engineering Course, First and Second Semesters: Three lecture periods and six laboratory hours per week.

Civil Engineering 25

Dams and Retaining Walls: A study of various types of dams and weirs, including timber, earth, masonry and rock fill dams, and of retaining walls.

Arches, Masonry and Foundations: The theory and design of arches, the methods and materials of construction of foundations and masonry structures.

Senior Year, First Semester, Civil Engineering Course: Five lecture periods per week.

Civil Engineering 26

Sewers: The course covers the various ways of disposal of sewage, sewer design and construction. Hydraulics is prerequisite for this course.

Junior Year, Second Semester, Civil Engineering Course. Two lecture periods per week.

Civil Engineering 29

Roads and Pavements: The modern construction of earth roads, country highways, city streets and pavements, materials, methods, economics and costs.

Senior Year, First Semester, Civil Engineering Course. Three lecture periods per week.

Civil Engineering 30

Irrigation, Water Power and Supply: The storage and distribution of water for irrigation and power. Water works for small cities.

Senior Year, Second Semester, Civil Engineering Course. Five lecture periods per week.

Civil Engineering 31

Contracts and Specifications. A course of one hour per week of reading and recitations.

Senior Year, First Semester. One lecture period per week.

Civil Engineering 32

Framed Structures: Structural details, the principles of detail, design of members and joints in timber and steel construction.

Senior Year, Second Semester, Civil Engineering Course. Three lecture periods and three laboratory hours per week.

PHYSICS AND ELECTRICAL ENGINEERING

Professor Swisher. Instructor .....

The Engineer, from the very nature of his profession, must deal with the material things about him and hence a knowledge of the laws governing the behavior of material things under certain definite conditions is of prime importance. The courses in Physics are intended to give a working knowledge of the fundamental principles involved in the following subjects: mechanics, heat, sound, light and electricity, thus giving the student a foundation for more detailed study in any of these subjects when he meets them in later work.

The courses in Electrical Engineering are intended to meet two specific needs. In the first place, courses are offered to meet the demands of any engineering student who goes out and who must handle electrical machinery as a source of power for his work. Other courses are offered covering the requirements of those students who expect to take up Electrical Engineering as a profession. In this connection, the courses of the first three years are intended to lay the foundation for study in both direct and alternating current work. During the fourth year more specialized courses are offered, giving opportunity to apply these general principles to more technical problems. The courses offered in the departments are as follows:

Physics 1 and 2

These courses are given in connection with the two years preparatory work to enable those coming from a high school which offers only two or three years work, to complete their entrance requirements here. Any student who is deficient in Physics for entrance will be required to make up this deficiency before entering the engineering courses.

First and Second Semesters: Four lecture periods and six laboratory hours per week.

Prerequisites: Algebra, through quadratics; one year of plane geometry.

Text Book: Millikan and Gale.

Physics 3 and 4

General College Physics: The first semester's work covers the general properties of matter, mechanics, and heat. The second semester includes sound, light and electricity. Special emphasis is placed on the more practical parts of the study including forces, work, transformations of energy, heat actions, optical instruments, and electrical circuits. The purpose of the work in the laboratory is first, to familiarize the student with the principles developed in the recitations, and second, to teach him to put experimental results in the form of an engneering report.

Required of all engineering students.

Sophomore Year, First and Second Semesters: Four lecture periods and three laboratory hours per week.

Prerequisites: Mathematics 7 and 8, and registration in Mathematics 9.

Text Book: Anderson's Physics for Technical Students.

Physics 5

Analytic Mechanics: In this course the fundamental principles of mechanics are developed and a large number of problems are worked giving the practical aplications of these principles to engineer-

ing. Special effort is made to develop in the student the ability to attack and work out problems for himself. Calculus methods are used freely when needed.

Some of the more important topics taken up are as follows: Composition and resolution of forces; conditions of equilibrium; centers of gravity, moments of inertia; laws of motion; friction; work and energy.

Junior Year, First Semester, for Students in Civil, Electrical and Mining Engineering. Elective for others.

Prerequisites: Mathematics 10, Physics 3.

Text Book: Poorman, Applied Mechanics.

Electrical Engineering 3

This course deals with the principles and general construction of dynamo electric machinery, systems of direct current distribution; direct current motors, their action, control and application; the principles and general construction of alternating dynamo electric machinery; systems of alternating current distribution, and alternating current motors. In the laboratory, practice is acquired in the use of instruments in the operating and testing of direct and alternating current generators, motors and transformers.

First Semester, Junior Year of Electrical Engineering Course, Senior Year of Civil Engineering Course: Four lecture periods and three laboratory hours per week.

Prerequisite: Mathematics 10, Physics 4.

Text Book: Gray, Principles and Practice of Electrical Engineering.

Electrical Engineering 4

Alternating Current Theory: In this course the fundamental principles underlying the behavior of single and polyphase systems are discussed. The relations between current, voltage and power in inductive and non-inductive circuits are dwelt upon,

and the principles developed are applied to the simpler types of machines.

Junior Year, Second Semester: Four lecture periods and three laboratory hours per week.

Prerequisite: Electrical Engineering 3.

Text Book: Timbie and Higbie, Alternating Current Electricity.

Electrical Enginering 5 and 6

Electrical Measurements and Calculations: These courses take up the fundamental principles of electric and magnetic circuits. They offer class room and laboratory practice in such things as Ohm's Law, Kirchhoff's Laws, Electrolysis, Self and Mutual Inductance, Hysteresis and Eddy Currents.

Junior Year for Electrical Engineering Course, First Semester: Three lecture periods and three laboratory hours per week, electives for others.

Prerequisite: Physics 3 and 4.

Second Semester: Elective.

Prerequisite: Electrical Engineering 5.

Text Book: Pender, Electricity and Magnet ism for Engineers.

Electrical Engineering 7

Advanced Alternating Current Theory: This course is a continuation of Electrical Engineering 4 and applies the principles to more techanical problems. The work of the course deals particularly with motors, generators, transformers, and transmission lines.

Senior Year, First Semester for Electrical Engineering Course: Four lecture periods and three laboratory hours per week.

Prerequisite: Electrical Engineering 4.

Text Book: Magnusson, Alternating Currents.

Electrical Engineering 8

Transmission Lines: This course continues the work of Electrical Engineering 7 and applies especially to the behavior of alternating currents

in transmission lines and the equipment connected therewith. Special attention is given to the present attitude toward long distance high tension transmission.

Senior Year, Second Semester, Electrical Engineering Course: Four lecture periods and three laboratory hours per week.

Prerequisite, Electrical Engineering 7.

Electrical Engineering 9

Meters and Control Apparatus: This course covers a detailed study of different types of meters and control apparatus used in connection with electrical power stations.

Senior Year, First Semester, for Electrical Engineering Course: Four lecture periods and three laboratory hours per week.

Prerequisite: Electrical Engineering 4.

Text Book: Jansky, Electrical Meters.

Electrical Engineering 10

Generating Plants and Substations: This course takes up the equipment and operation of both steam and hydro electric generating stations and that of transformer and substations including turbines, generators, transformers, switch board equipment, insulation and protective appliances.

Senior Year, Second Semester, Electrical Engineering Course: Four lecture periods per week.

Prerequisite: Electrical Engineering 4.

Electrical Engineering 11

Light and Illumination: This course includes a discusion of the principles of artificial lighting and means a study of the present trend in electric lighting systems.

Senior Year, First Semester, for Electrical Engineering Course: Three lecture periods per week.

Prerequisite: Electrical Engineering 4.

Electrical Enginering 12

Electrical Machinery: This course deals with the application of electrical machinery to the industries especially to mining work.

Senior Year, Second Semester, Electrical Engineering Course: Elective for others. Three lecture periods and three laboratory hours per week.

Prerequisite: Electrical Engineering 3.

Electrical Engineering 13 and 14

Electrical Design: In this course the factors determining the behavior, characteristics and cost of different types of electrical machinery are discussed and applied to the actual design of certain machines.

Senior Year, First and Second Semesters of Electrical Engineering Course: Six laboratory hours per week.

Prerequisite: Electrical Engineering 4.

STEAM ENGINEERING

Thermo-Dynamics: This course begins with a discussion of the theory underlying the operation of heat engines. The theory of operation of the ideal engine is developed, and the principles governing the action of steam and gas engines, air compressors and refrigerating machines are fully discussed.

Power Plants: This course applies practically the principles developed under thermodynamics. It embraces the history of the development of the steam engine, and a study of the types in successful use; the application of the indicator and the Prony brake; the study of the steam boiler, and the testing of boilers and fuels. A Thompson indicator, a Prony brake with Fairbanks scales, a Standard Crosby test gauge, and a Carpenter steam separating calorimeter are available for laboratory work.

The school has three boilers aggregating 250 horse-power, and a 40 horse-power Corliss engine; also a gasoline and a kerosene engine. This apparatus is also available for laboratory work.

Second Semester, Junior or Senior Year for Civil and Electrical Engineering Courses. Elective for others. Given alternate years with Hydraulics. (Not given 1920-1921). Three lecture periods per week for the semester and three laboratory hours per week for a half semester.

Prerequisite: Physics 3.

Hydraulics

Hydraulics: The student takes up this course with a knowledge of hydrostatics from his work in Physics 3 and the principles of mechanics from Physics 5 and is thus prepared to commence with hydraulics proper, or the study of the laws governing the motion of water.

The school is favorably situated for field work in hydraulics. Rapid creek is a mountain stream with a fall of about 1.6 per cent., offering splendid facilities for wier and velocity measurements; two large irrigation ditches are adjacent to the school, and Rapid City has three water-power plants within the city limits. The students thus have opportunity to visit and study hydraulic power plants in successful operation.

Second Semester, Junior or Senior Year for Civil and Electrical Enginering Courses. Elective for others. Given alternate years with Steam Engineering (not given 1920-1921). Three lecture periods and three laboratory hours per week for a half semester.

Prerequisite: Physics 5.

Text Book: Mansfield Merriman's Treatise on Hydraulics.

WIRELESS TELEGRAPHY

The Physics Department has charge of the School of Mines Radio Station. The station is completely equiped with up to date sending apparatus and two complete receiving sets. One of these is for arc, or continuous waves, and has a guaranteed receiving radius of 9,000 miles. The other is for spark, or damped wave, signals. This is intended for shorter range than the other, but we have copied messages from all parts of the United States with it.

Effort is made to keep in step with the most recent developments in this relatively new branch of electrical work and the new apparatus is being added as needed to keep it up to date.

ENGLISH

Professor McLearie

The aim of this department is to give the student a command of good idiomatic English and to aid him in the development of the art of expression. Special emphasis is laid upon the importance of good composition in technical work. Attention is called to the absolute necessity that every professional man should be able to express his thoughts with clearness and accuracy.

English 5-6 and 7-8

These courses cover a study of the principles of writing. They include punctuation, letter and business forms, analysis of models, writing of compositions, and study of American and English literature with particular reference to English classics. The courses are available to those who may be deficient in entrance requirements. They cover five lecture periods each per week.

English 9

The Elements of Effective Writing: This course gives both theoretical and practical instruc-

tion. The theory is taught by class room work based on standard text books. The practice is obtained by exercises, written in the class room, and by weekly themes. At least one theme a week is required and every theme is returned to the student to be revised or rewritten.

Freshman Year, First Semester: Four lecture periods per week.

Text Books: Canby's English Composition; Steeves and Ristine's Representative Essays in Modern Thought; Eason and Weseen's English, Science and Engineering; Aydelotte's English and Enginering.

English 10

This course supplements the work of the first semester by giving further practice in narrative, expository and argumentative writing. A study is made of the works of such authors as will aid in practical composition work. Three themes are required, each containing from 800 to 1,000 words. There are conferences on each theme.

Freshman Year, Second Semester: Four lecture periods per week.

Sociology 1

This course is introductory in character. It consists of lectures and required reading on the contents and methods of Sociology. The physical, biological and psychological aspects of social evolution are discussed.

Junior Year, First Semester: Three lecture periods per week.

Text Book: Blackmar and Gillin's Outlines of Sociology.

Sociology 2

This course is a continuation of Sociology 1. It also includes a study of social problems and reform movements. As far as practical, particular attention is directed to the social aspects of business and public affairs.

Junior Year, Second Semester: Three lecture periods per week.

Economics 1

This course gives a brief survey of the principles of economics. It traces the history of economic development and studies the facts and forces in our present economic organizations. It is designed to meet the needs of students whose work lies in professional departments, particularly engineering.

Junior Year, First Semester: Three lecture periods per week.

Text Books: Ely's Outline of Economics; Fetter's economic Principles; Turner's Introduction to Economics.

Economics 2

This course is supplementary to Economics 1. It includes discussions of the more important contemporary economic problems. The emphasis is placed upon the consideration of such topics as: Industrial Combinations and Monopolies, Labor and Labor Organizations and Corporation Finance.

Junior Year, Second Semester: Three lecture periods per week.

Economics 11, 12

These courses are designed to give the student an intensive knowledge of some one field of modern economic principles, as well as to give training in the gathering and correlation of material. For 1920-1921, the special subject considered will be. "Problems of Labor and Employment."

Prerequisites: Economics 1 and 2.

First and Second Semesters: Three lecture periods per week.

Sociology 11, 12

These courses aim to give the student an opportunity to make a critical study of some modern social problems. For 1920-1921, the topic discussed will be, "Radical Social Theories."

Prerequisites: Sociology 1 and 2.

First and Second Semesters: Three lecture periods per week.

Many up-to-date reference books are available to students selecting the above courses.

BIOLOGY

Associate Professor Leete.

Instruction in biological subjects is given by appropriate text books, lectures supplemented with charts, models and blackboard illustration, and by laboratory exercises. In the laboratory the student is required to make his own observations and to record them by drawings, diagrams or written conclusions. A special effort is made to correlate the laboratory and class-room work.

The elementary courses aim by their class-room and laboratory work to familiarize the student with representative forms of plant and animal life, their structure and life processes, and to train him in making and recording his own observations. All courses in biology are cultural but groups of them will contribute largely toward a broad foundation for scientific agriculture, medicine, forestry, and other biological professions. Some of the courses are of particular service in preparing the student for certain of the geological studies given in the Enginering Courses.

The department is especially fortunate in its laboratory equipment, and facilities for study which are more fully described elsewhere.

The courses offered by the department are as follows:

Biology 1-2

General Biology: An introduction to the general facts and principles with regard to the structure, physiology, development, life history, relationships, and activities of plants and animals.

Especial emphasis is given to those forms of life which are of general interest and to civic and economic problems related to biology. Lectures, recitation and laboratory work.

This course is designed especially for third year preparatory students.

First and Second Semesters: Three lecture periods and three laboratory hours per week.

Biology 3

Zoology: In this course a detailed study is made of a few representative forms of each of the main groups of animals. The main emphasis is given to structure and classification, but considerable attention is also given to development, life history, activities, economic questions, and to the main facts and approved hypotheses which are the basis of modern conceptions of animal life.

First Semester: Three lecture periods and three laboratory hours per week.

Text Book: Animal Forms, by Jordan, Kellogg and Heath.

Biology 4

Botany: In this course, the general facts and principles with regard to the structure, physiology, and interrelations of plants are first taken up. Later, a more detailed study is made of each of the great groups of plants. Especial emphasis is given those forms which are related to everyday life and which have the largest significance to the public in general. Some of the more important subjects treated in the course are bacterial and fungous diseases, the propagation of plants, plant breeding, plant products, and forestry.

Second Semester: Three lecture periods and three laboratory hours per week.

Text Book: Bergen and Caldwell, Practical Botany.

Biology 5

Physiology: Recitations with laboratory study of skeleton, anatomical charts and models, prepared slides and dissection of domestic animals. A general survey of the anatomy and physiology of the human body, with simple treatment of such related topics as food values and hygiene.

Four lecture periods per week for one semester.

Biology 6

Evolution: The aim of this course is to present to the student the processes of evolution as they are so far understood. Animals and plants serve as illustrative material. Some of the topics considered are: the formation of species, heredity, mutation, degeneration, instinct and reason.

One Semester: Three lecture periods per week.

Text Book: Metcalf, Organic Evolution.

Biology 7

Forestry in Relation to Mining: This course deals in a broad way with such subjects as important timber-producing trees, their identification, quality of wood, distribution, and economic importance; the protection and management of timber lands; timber surveys and estimates; the preservative treatment of timber; logging and utilization; and the National Forests.

Lectures and special references to standard works on forestry subjects.

Two lecture periods per week for one semester.

MODERN LANGUAGES

Miss Robinson.

This department is open to all students desiring to become acquainted with the scientific knowledge of the languages taught as well as their literary value. French has an importance in the study of the sciences. The rapidly developing trade

relations with the Hispanic-American countries have made an increasing demand for Spanish. (Classes in German are not now being organized.) Optional courses in French and Spanish in addition to those here outlined are offered to technical and non-technical students.

French 1-2

Elementary French: This course is intended for those who begin French at the School of Mines. Its aim is to enable the student to read ordinary French with ease, to understand to some extent the language when spoken, and to form simple sentences, both oral and written.

First and Second Semesters: Three lecture periods per week.

Texts and Readings: New Chardenal; Composition from Francois; Halevy; L'Abee' Constantin; Hugo, Les Miserables.

French 3-4

Advanced Prose Composition: This course is conducted mainly in French. The work is based upon selected texts and drill is also given in the writing of French themes and letters.

First and Second Semesters: Three lecture periods per week.

Readings: Labiche and Martin, Le Voyage de M. Perrichon; Dumas, La Tulipe Noire.

French 5-6

A course in scientific French will be offered to students having completed French 3-4.

Freshman Year, First and Second Semesters: Three lecture periods per week.

Text: Fraser and Squairs Grammar.

Spanish 1-2

Elementary Spanish: This course aims to give a knowledge of the essentials of Spanish grammar, the ability to read ordinary Spanish with ease, and some practice in conversation.

Freshman Year, First and Second Semesters: Three lecture periods per week.

Text and Readings: DeVitis, Spanish Grammar; Roessler and Remy; Geddes, Padre Isla's Lesage's Gil Blair.

Spanish 3-4

Advanced Spanish: Grammar is reviewed by means of composition and conversation. Modern novels and plays are read. This course is a continuation of Spanish 1-2 but more advanced in character.

Sophomore Year, First and Second Semesters: Three lecture periods per week.

Readings: Galdos, Marinaela; Hill, Spanish Short Stories.

Special Spanish 5-6

A three hour course is offered for upper classmen who are expected to cover the same amount of work as that offered in Spanish 1. Particular attention is given to conversation and commercial forms.

SHOP WORK

Wood Work: The work in the wood shop aims to train the student in the use of wood-working tools and machinery and to familiarize him with the properties of the common woods. The use of simple tools is first learned and this is followed by work on the turning lathe, universal wood-worker, etc. Pattern making is studied in its relation to molding; the practical construction of patterns to prevent warping and distortion; the making of special patterns, cores and core boxes, introducing draft shrinkage, finish and the technical appliances and usages of modern pattern work.

Freshman Year, First and Second Semesters: Three laboratory hours per week.

Shop Work 3-4

Forge and Machine Shop Work: This course begins with simple exercises in upsetting, bending, twisting, punching and welding. The work gradually becomes more difficult, such as making eye-bolts, chains, and tongs. Tool-making is then begun by making screw-drivers, hammers and chisels, to be used later in the machine shop. Forging includes the care of blacksmith's fire and tools, the study of forging, tempering, welding, and case hardening. The instructor makes the student familiar with the best grade of steel to be used for any required purpose, and the correct shape and temper necessary for the best work in cutting iron, steel, brass, and stone. The machine shop work includes molding, casting, use of the oxy-acetylene welding apparatus, the operation of the drill press, lathe, shaper, buffer and hack saw. Practice work in the machine shop concludes this course.

Sophomore Year, First and Second Semesters: Three laboratory hours per week.

LIST OF STUDENTS, 1919-20

Senior Class

Gantz, Gardner ..... Rapid City, S. D.
Johnson, J. Harlan ..... Philadelphia, Pa.
Mallman, Adolph ..... Farmingdale, S. D.
Waldschmidt, Willam A. ..... Lead, S. D.
White, Luther M. ..... Dressor, Ill.

Junior Class

Aikman, William ..... Hermosa, S. D.
Enos, George ..... Cottonwood, S. D.
Jacobs, Morris ..... Rapid City, S. D.
Kalb, J. Lorenz ..... Rochester, Minn.
Lintz, Mark ..... Hermosa, S. D.
Platt, Charles ..... Rapid City, S. D.
Parsons, Merle ..... Rapid City, S. D.
Richardson, George ..... Sioux Falls, S. D.
Schrader, Houston ..... Rapid City, S. D.
Snyder, William ..... Rapid City, S. D.
Wurtsbaugh, C. Guy ..... Irwin, Iowa

Sophomore Class

Christensen, Harold ..... Rapid City, S. D.
Elliott, Floyd H. ..... Oregon, Ill.
Gantz, Frank E. ..... Rapid City, S. D.
Hammerquist, Charles ..... Rapid City, S. D.
Hayes, Joel ..... Rapid City, S. D.
Hett, Paul ..... Lead, S. D.
Hoffman, Edgar ..... Keystone, S. D.
Johnson, George W. ..... Davenport, Iowa
Johnson, Arthur I. ..... Lead, S. D.
McCracken, George L. ..... Hot Springs, S. D.
March, Raymond ..... Hot Springs, S. D.
March, Guy ..... Hot Springs, S. D.
Markvart, Edwin ..... Chicago, Ill.
Moore, Ross E. ..... Aberdeen, S. D.
Norris, Paul ..... Haydraw, S. D.
Perrigo, Harry ..... Hermosa, S. D.
Primrose, William S. ..... Lead, S. D.
Romig, Woodfred ..... Morgan, Texas
Schuler, William ..... Tinton, S. D.

Smith, Carrol M. ..... Rapid City, S. D.
Snyder, John P. ..... Providence, R. I.
Stewart, Max K. ..... Rapid City, S. D.

Freshman Class

Anderson, Earl ..... Sturgis, S. D.
Anderson, Payton ..... Rapid City, S. D.
Anderson, Ludlow ..... Kooi, Wyo.
Babcock, Harrold ..... Belle Fourche, S. D.
Babington, Morgan ..... Whitewood, S. D.
Best, Clare ..... Meadville, Pa.
Binckley, Basil ..... Rapid City, S. D.
Bowen, Herman L. ..... Lead, S. D.
Brown, George D. ..... Rapid City, S. D.
Bryant, Stewart J. ..... Lead, S. D.
Calhoun, Paul T. ..... Hot Springs, S. D.
Cha, Angelo ..... Lead, S. D.
Craven, Thomas L. ..... Belle Fourche, S. D.
Deutsch, Raymond ..... Rapid City, S. D.
Dickinson, Everett ..... Underwood, S. D.
Cordes, Richard ..... Rapid City, S. D.
Duncan, Houston ..... Sheridan, Wyo.
Feigel, Mary ..... Rapid City, S. D.
Friday, Marshall ..... Oshkosh, Wis.
Gamble, Eldon ..... Cloquet, Minn.
Germain, George ..... Milbank, S. D.
Grey, Alex ..... Rapid City, S. D.
Haas, Maurice ..... Whitewood, S. D.
Hall, Robert L. ..... Lead, S. D.
Ham, Ernest B. ..... Rapid City, S. D.
Hatfield, Gene P. ..... Newcastle, Ind.
Hawley, George E. ..... Rapid City, S. D.
Jepsen, Marvin ..... Rapid City, S. D.
Johnson, Everett ..... Lead, S. D.
Knox, Walter ..... Clear Lake, S. D.
Lindsey, John ..... Santee, Neb.
Long, Paul ..... Belle Fourche, S. D.
Lund, Cecil ..... Rapid City, S. D.
Mitchell, Fred ..... Williamsport, Ohio
Monson, Harold ..... Sioux Falls, S. D.
Niece, Donald ..... Elmwood, Ill.
Platt, Edward ..... Rapid City, S. D.
Roehr, Richard ..... Dayton, Ohio
Saunders, Wesley L. ..... Niobrara, Neb.

Scott, Paul Dean .....Irving Park, Ill.
Shedd, Bates .....Lead, S. D.
Stroup, Charles .....Fort Pierre, S. D.
Teall, Homer .....Philip, S. D.
Tyrrell, Harvey .....Rapid City, S. D.
Underwood, Lawrence E. .....Knightstown, Ind.
Wagner, Henry .....Lead, S. D.
Westover, Maurice .....Fairburn, S. D.

Special Students

Bentley, Charles .....Rapid City, S. D.
Holt, Frank .....Trenton, New Jersey
Stone, Gottfried .....Rapid City, S. D.
Shaw, Glen P. .....Wasta, S. D.
Traphagen, Harriett Van L.....Golden, Colo.
Willesen, Willie Harkier .....Clear Brook, Minn.

Preparatory Students

Allen, Glen P. .....Wessington, S. D.
Anderson, Warren .....Rapid City, S. D.
Bentley, James .....Rapid City, S. D.
Biggs, Clifford .....Sioux City, Iowa
Brodsky, Frank .....Owanka, S. D.
Brown, Wallace .....Belle Fourche, S. D.
Dake, Earl D. .....Wessington, S. D.
Dale, William .....Rapid City, S. D.
Donegan, Ivo. .....Wichita Falls, Texas
Craven, William I. .....Belle Fourche, S. D.
Fierstine, Warren .....Scenic, S. D.
Fredin, Pierre .....Mission Hill, S. D.
Gadski, Richard .....Chicago, Ill.
Hansen, Ralph W. .....Whitewood, S. D.
Harmon, Ingwald .....Draper, S. D.
Hearn, Miles .....Rapid City, S. D.
Hoyt, Stanley .....South Norwalk, Conn.
Keown, Harold .....Rapid City, S. D.
Lorimer, Earl .....Caputa, S. D.
Marsh, Ralph .....Rapid City, S. D.
Marsh, Corbin .....Rapid City, S. D.
Mulcahy, Edwin .....Rapid City, S. D.
Novy, Darwin .....Rapid City, S. D.
O'Harra, Wayne .....Rapid City, S. D.
Olsen, Lester .....Hartley, S. D.
Phillips, Lester .....Midland, S. D.
Platt, Ralph .....Rapid City, S. D.

Sands, William .....Rapid City, S. D.
Sargent, Fred .....Trojan, S. D.
Smith, Carrol B. .....Rapid City, S. D.
Todd, Lewis .....Rapid City, S. D.
Turner, Ralph D. .....Hot Springs, S. D.
Vercellino, Fred D. .....Lead, S. D.
Walker, Leonard .....Midland, S. D.
Watkins, Harold .....Powell, S. D.
Westover, John .....Fairburn, S. D.
Wilson, Elmer .....Rapid City, S. D.

ALUMNI

Alder, Alfred, Jr., B. S. in Metallurgical Engineering, '13. Mill Superintendent, Nevada Packard Mines Co., Lower Rochester, Nevada.

Alger, Otille Behrens, B. S., Custer, S. D.

Anderson, Amil Abner, B. S. in Metallurgical Engineering, '13; Met. Eng. '17. Peroleum Geologist, Denver, Colorado.

Anderson, Frank, B. S. in Mining Engineering, '17. Engineer, Amerilla, Texas.

Anderson, William L., B. S. in Metallurgical Engineering, '11; Met. E. '14. Metallurgical Engineer, Lower Rochester, Nevada.

Anderson, O. Allen, B. S. in Mining Engineering, '04; E. M. '07. Superintendent, August Mining Co., Landusky, Montana.

Arentz, Samuel S., B. S. in Mining Engineering, '04; E. M. '06. Consulting Engineer, Dooly Building, Salt Lake City, Utah.

Bennett, Richard T., B. S. in Mining Engineering, '10. Petroleum Geologist, Tulsa, Oklahoma.

Betterton, Jesse O., B. S. in Metallurgical Engineering, '09; Met. E. '12. Chief Metallurgist, The Rhodesia Broken Hill Development Co., Broken Hill, Rhodesia, Africa.

Bochert, William C., B. S. in Mining Engineering, '14; E. M. '17. Professor of Mining, South Dakota State School of Mines, Rapid City, S. D.

Booth, Lionel E., B. S. in Metallurgical Engineering, '15. In charge of Ore Testing and Research Work, General Engineering Co., Salt Lake City, Utah.

Brooks, Floyd, B. S. in Metallurgical Engineering, '11. Assistant Mines Superintendent, Black Lake Asbestos and Chrome Co., Limited, Black Lake, Quebec, Canada.

Bryant, Frank, B. S. in Mining Engineering, '07; E. M. '11. Mine Foreman, Kendall Leasing Co., Kendall, Montana.

Clark, Edwin, B. S. in Mining Engineering, '18. Instructor in Mathematics, University of Minnesota, Minneapolis, Minnesota.

Clevenger, G. Howell, B. S. in Mining Engineering, '01; E. M. '08; A. M., Columbia University. Chairman, Metallurgy Section, National Research Council, 33 West 39th St., New York City. Director of American Institute of Mining and Metallurgical Engineers.

Coolidge, Edwin, B. S. in Mining Engineering, '06; E. M. '11. General Manager, St. Paul-Montana Mining Co., Maiden, Montana.

Coolidge, Cyril, B. S. in Mining Engineering, '08; E. M. '12. Phelps Dodge Corporation, Warren, Arizona.

Coolidge, Roy R., B. S. in Mining Engineering, '09; E. M., '11. Deceased, January 7, 1919.

Cragin, Rodney, B. S. in Metallurgical Engineering, '16. Petroleum Geologist, Burk Burnett Oil Fields, Grandfield, Okla.

Cornell, Wharton, B. S. in Mining Engineering, '07. Deceased, June 2, 1918.

Cremer, Frank, B. S. in Mining Engineering, '17. Engineer. State Highway Commission, Pierre, South Dakota.

Curran, Harry T., B. S. in Mining Engineering, '06; E. M., '08. Mill Superintendent, Ben Harrison Mine, Baker, Oregon.

Dawes, Eva Robinson, B. S., A. M. Formerly Professor of Home Economics, University of South Dakota, Vermillion, S. D. Address, Brookings, S. D.

Dennis, Paul, B. S. in Metallurgical Engineering, '16. Petroleum Geologist, Burk Burnett Oil Fields, Grandfield, Okla.

Deutsch. Harry, B. S. in Metallurgical Engineering, '18. Metallurgical Engineer, Aluminum Castings Co. Address, Helen and Six Mile Road, Route 3, Detroit, Mich.

Dickey, Samuel C., B. S. in Mining Engineering, '12. Mining Engineer, Creede, Colorado.

Eddy, John, B. S. in Mining Engineering, '10. Assayer, Timber Butte Milling Co., Butte, Montana.

Ehle, Chester G., B. S. in Mining Engineering, '11. Water Engineer, City Hall, Portland, Oregon.

Eldridge, Robert, B. S. in Metallurgical Engineering, '14. Surveyor, Colorado Springs, Colo.

Ellerman, Otto, B. S. in Mining Engineering, '07; E. M. '11. State Inspector of Mines, Lead, S. D.

Elliott, John Wing, B. S. in Mining Engineering, '10. Manager. Columbus Auto Co., Columbus, Nebraska.

Fahrenwald, Frank A., B. S. in Mining Engineering, '12; E. M., '14, South Dakota State School of Mines; M. S., Pennsylvania State College; Ph. D., University of Michigan. Consulting Metallurgist, 1692 Glenmount Road, Cleveland, Ohio.

Fahrenwald, Arthur W., B. S. in Metallurgical Engineering, '14. Met. E., '16. Instructor, University of Idaho, Metallurgist, Idaho Bureau of Mines, Moscow, Idaho.

Farnham, Lloyd L.. B. S. in Mining Engineering, '14. Petroleum Geologist, Thermopolis, Wyo.

Feigel, Carrie, B. S. Deputy Clerk of Courts, Rapid City, S. D.

Fleichman, Leo., B. S. in Mining Engineering, '14. Mine Superintendent, Rowena, Colorado.

Flower, George Earl, B. S. in Metallurgical Engineering, '10. Superintendent, Cleveland Filtration Plant, Cleveland, Ohio. Address: 1542 Olivewood, CLakewood, Ohio.

Gaines, William, B. S. in Mining Engineering, '06. Superintendent, Montana Mines and Metal Co., Norris, Montana.

Gates, Clyde, B. S. in Mining Engineering, '15. Instructor in Mathematics, Rapid City High School, Rapid City, S. D.

Goodner. Ivan E., B. S. in Metallurgical Engineering, '08. Engineer, Columbia Basin Irrigation Project, Spokane, Washington. Address, 28 Terminal Building.

Hall, Arthur E., B. S. in Mining Engineering, '04; Met. E., '06. General Superintendet, American Smelting and Refining Co., Omaha, Nebraska.

Hall, Ralph Julius, B. S. in Metallurgical Engineering. '19. Structural Engineer, Northwestern Quarry Co., Rapid City, S. D.

Hally, James, Jr., B. S. in Mining Engineering, '05. Cashier, Keystone Bank, Keystone, S. D.

Hancher. John W., B. S., M. S., South Dakota State School of Mines; A. M., Mount Union College; LL.D., Simpson College. Associate Secretary of the Board of Education of the Methodist Episcopal Church, 150 Fifth Avenue, New York City.

Hartgering, J. M., B. S. in Metallurgical Engineering, '13. With Clarence W. Hubble, Consulting Engineer, Penobscot Building, Detroit, Michigan.

Hebblethwaite, L. L.. B. S. in Mining Engineering, '08. Evanston, Ill.

Henton, Hugh M., B. S. in Metallurgical Engineering, '13. Instructor in Metallurgy, Case School of Applied Science, Cleveland, Ohio.

Hill, Robert S., B. S. in Mining Engineering, '14. Diamond Prospector, care Forminiere Mission. Kasai, Ashikapa, Congo Belge, via Boma and Luebo.

Hill, Joseph H., B. S. in Mining Engineering, '16. Diamond Prospector, care Forminiere Mission, Kasai, Ashikapa, Congo Belge, via Boma and Luebo.

Hopkins, Max, B. S. in Mining Engineering, '01. Vice President and Sales Manager, Electra-Texas Oil Lands Co., Milwaukee, Wis.

Hvistendahl, Eli A., A. B., University of South Dakota; B. S. in Mining Engineering, '09, South Dakota State School of Mines. Chemist, in charge of Chemical Laboratory, American Smelting and Refining Co., Omaha, Nebraska.

Ives, Glen P., B. S. in Mining Engineering, '08; E. M. '12. Leasing Mineral de Talca, Ovalle, Chile, South America.

Jeffries, Zay, B. S. in Mining Engineering, '10; Met. E.. '14. Director of Research for Aluminum Manufactures, Inc., also Consulting Metallurgist for General Electric Co. Address, 2800 Harvard Ave., Cleveland, Ohio.

Jones, H. W., A. B., University of South Dakota; B. S., in Mining Engineering, '09, South Dakota State School of Mines. Farmer, Rapid City, S. D.

Ledyard, Lewis, B. S. in Metallurgical Engineering, '09. Mining Engineer, Teck-Hughes Gold Mines, Kirkland Lake, Ontario.

Marshall, Willard C.. B. S. in Mining Engineering, '09. Rapid City, S. D.

Mara, Hubert Wilbur, B. S. in Metallurgical Engineering, '19. Techatticup Mine, Nelson, Nevada.

Matson, Bernard, B. S. in Mining Engineering, '07. Superintendent Refinery, United States Mint, Denver, Colorado.

McCauley, Willard J., B. S. in Mining Engineering, '14. Mining Engineer, Ray, Arizona.

Meents, R. O., B. S. in Mining Engineering, '14. Mining Engineer, Miami, Arizona.

Mellinger, Lloyd, B. S. in Mining Engineering, '07. Deceased, December 26, 1918.

Morris, Milton, B. S. in Mining Engineering, '07. Chemist, Philipsburg Mining Co., Philipsburg, Montana. Care Bi-Met.

Mosier, Peter, B. S. in Mining Engineering, '12. Engineer, Inspiration Copper Co., Inspiration, Arizona.

Muhmel, Fred J., B. S. in Mining Engineering, '11. Scotland, S. D.

Nelson, Harold Lee, B. S. in Mining Engineering, '19. Engineer, Dakota Engineering Co., Mitchell, S. D.

Newbowers, Frank J., B. S. in Mining Engineering, '18. With Flynn and Co., Rapid City, S. D.

O'Brien, B. D., E. E. Rose Polytechnic, '96; B. S. in Metallurgical Engineering, '06; E. M., '10. South Dakota State School of Mines. Sundance, Wyoming.

O'Harra, B. Marvel, B. S. in Metallurgical Engineering, '15. Superintendent, Bismuth Department, American Smelting and Refining Co., Omaha, Nebraska.

Ossa, Ignacio Diaz, B. S. in Metallurgical Engineering, '08. Engineering Office, Santiago, Chile, South America.

Overpeck, Areli C., B. S. in Mining Engineering, '02; E. M., '06. Examining Engineer, Bureau of Mines, 334 West 53rd Street, Los Angeles, California.

Overpeck, Hollis W., B. S. in Mining Engineering, '05; E. M., '07. Mine Superintendent, Oliver Iron Mining Co., Buhl, Minnesota.

Overpeck, Lem S., B. S. in Mining Engineering, '08. With Frazier and Johnson Commission Co., South Omaha, Nebraska.

Penhoel, Louis, B. S. in Mining Engineering, '06. Mining Engineer, Southwestern Engineering Co., 1221 Hollingsworth Bldg., Los Angeles, California.

Poznansky, Benjamin, B. S. Deceased, December 12, 1918.

Price, Virgil T., B. S. in Metallurgical Engineering, '17. Chemist, American Smelting and Refining Co., Omaha, Nebr.

Pryer, W. Christy, B. S. in Metallurgical Engineering, '14. In Testing Laboratory, Anaconda Copper Co., Anaconda, Montana.

Quinney, Elwin H., B. S. in Mining Engineering, '11; Met. E., '13. County Highway Supt. of Beadle County, Huron, S. D.

Read, J. Burns, B. S. in Mining Engineering, '06; E. M. '08. Assistant Professor of Mining, University of Illinois, Urbana, Illinois.

Read, Herbert, B. S. in Mining Engineering, '09. E. M., '11. Denver, Colorado.

Sargent, Arthur E., B. S. in Metallurgical Engineering, '10. General Manager, Mogul Mine, Terry, S. D.

Saville, Joseph H., B. S. in Metallurgical Engineering, '10; E. M., '12. Assistant Manager, Pyrites Co., Wilmington, Del.

Seiter, Herbert, B. S. in Mining Engineering, '06. Merchant, Albion, Nebraska.

Smith, Earl Van L., B. S. in Mining Engineering, '06. Akron, Ohio.

Smith, Elwyn, B. S. in Metallurgical Engineering, '16. In charge of Ore Dressing Dept., Dept. of Metallurgy, Minnesota School of Mines, University of Minnesota, Minneapolis, Minn.

Sparling, W. G., B. S. in Mining Engineering, 08. In County Auditor's Office, Rapid City, S. D.

Stoner, John William, B. S. in Mining Engineering, '10. Mining Engineer, Judge Mining and Smelting Co., Park City, Utah.

Stout, Herbert, B. S. in Metallurgical Engineering, '18. Mining Engineer, United States Gypsum Co., Fort

Dodge, Iowa. Address, 216 S. 16th St., Fort Dodge, Iowa.

Stowell, George E., B. S. in Mining Engineering, '14. Resident Mining Engineer for Southwest Oregon. Oregon Bureau of Mines and Geology. Address, 508 S. Grape St., Medford, Oregon.

Thiel, Arthur, B. S. in Metallurgical Engineering, '15. Highway Engineer, Alexandria, S. D.

Thompson, C. C., B. S. in Mining Engineering, '02; E. M., '06. United States Deputy Mineral Surveyor for Nevada, Goldfield, Nevada

Van Nuys, C. C., A. B. Yankton College; B. S. in Mining Engineering, '07; E. M., '10, South Dakota State School of Mines; A. M., Columbia University. In charge of Department of Liquefaction and Research, Air Reduction Co. Address, 559 W. 191st St., New York City.

Wells, Leon Peck, B. S. in Mining Engineering, '07. Address unknown.

Wetherald, Frederick, B. S. in Mining Engineering, '06; Met. E., '14. 39 Eldom Street, Dorchester, Mass. With Stone and Webster, Engineers, Boston, Mass.

West, Elmer, B. S. in Mining Engineering, '04; E. M., '06. Chemist, Philipsburg Mining Co. Address, 434 1st National Bank Bldg., Long Beach, Calif.

Wheelock, Harry Ellis, B. S. in Mining Engineering, '10. Mining Engineer, 85 Mining Co., Valedon, New Mexico.

Whitmore, Charles, B. S. in Mining Engineering, '07. County Highway Superintendent, Canton, S. D.

Whytock, Peter, B. S. in Mining Engineering, '06. Mining Engineer, Tonopah, Nevada.

Willard, Clarence G., B. S. in Metallurgical Engineering, '11; Met. E., '14. Metallurgist, Marcy Mill Department, Mine and Smelter Supply Co., Denver, Colorado.

Winters, Fred W., B. S. in Mining Engineering, '08; E. M., '11. Lake City, Minnesota.

Winsor, Frank H., B. S. in Metallurgical Engineering, '11. Assistant Cashier, First National Bank, Mitchell, S. D.

Wolcott, Guy E., B. S. in Mining Engineering, '04. Mining Engineer, Cripple Creek, Colorado.

Wong, Yu-Chih, B. S. in Metallurgical Engineering, '18. Graduate Student, Columbia University. Address, 414 West 118th St., New York City.

Woodard, D. C., B. S. in Mining Engineering, '08. Leasing, Mineral de Talca, Ovalle, Chile, South America.

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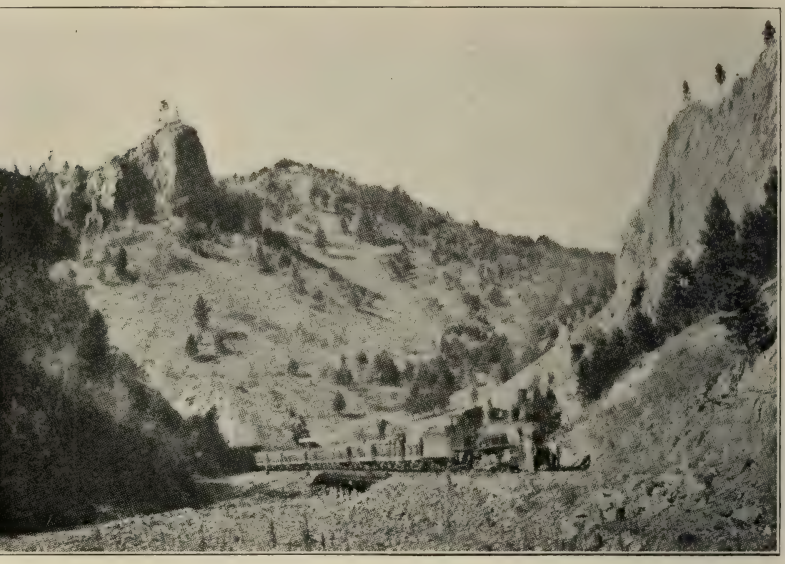
Rapid City, South Dakota



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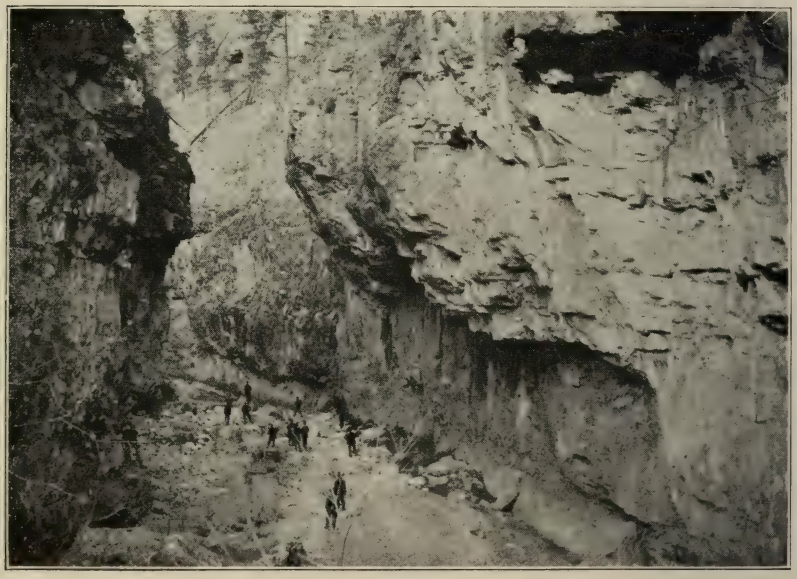

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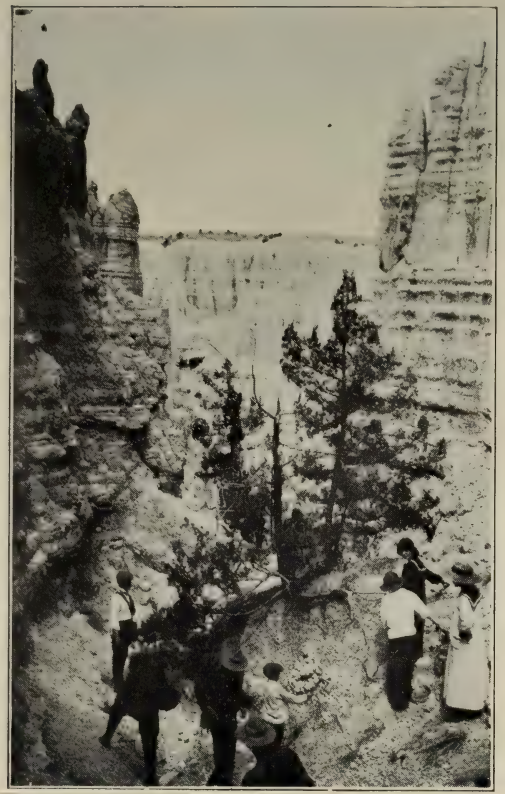

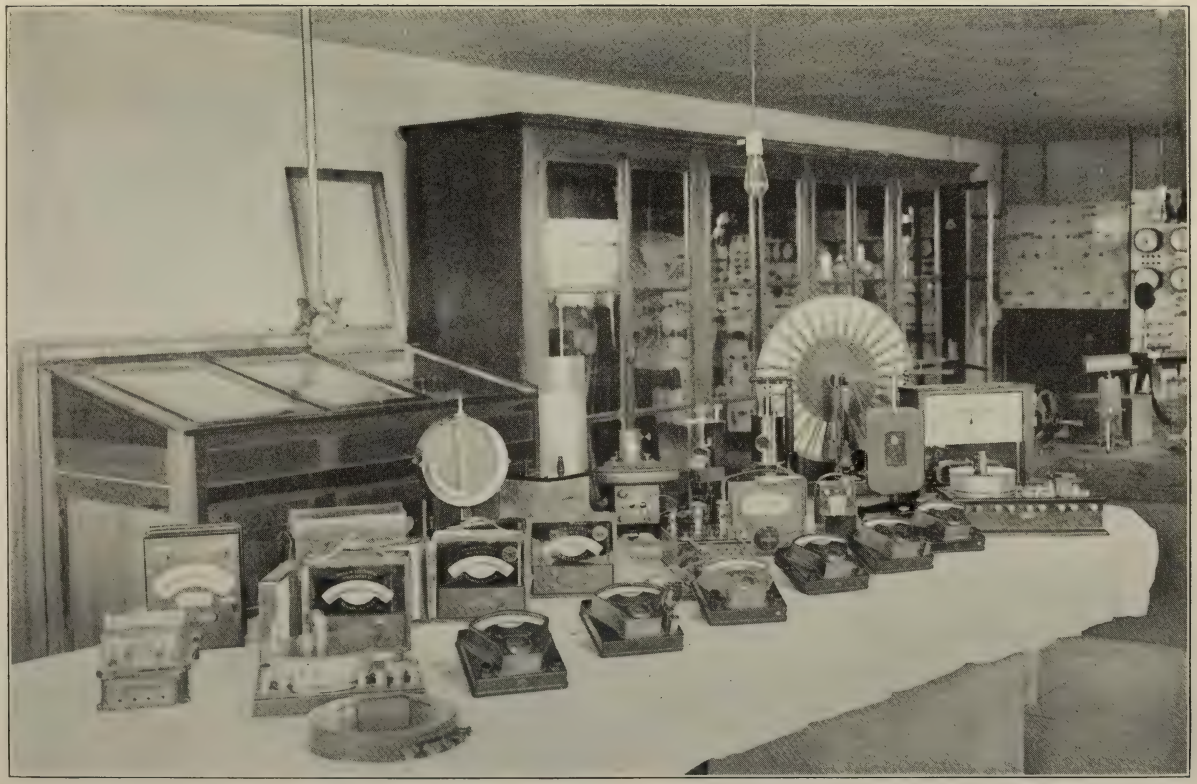

ELECTRICAL MEASURING APPARATUS

METALLURGICAL VIEWS

GEOLOGICAL MUSEUM

IN THE HOMESTAKE MINE

THE HOMESTAKE MINE AND MILLS FROM ELLISON HOIST

HARNEY RANGE

HARNEY NEEDLES NEAR SYLVAN LAKE

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South Dakota State School of Mines

Annual Catalog
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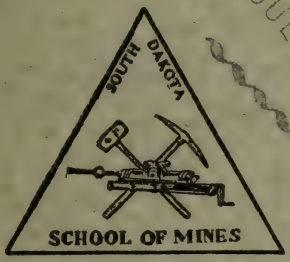

With Announcements for 1921 - 1922

RAPID CITY, SOUTH DAKOTA

June 1921

South Dakota State School of Mines

Annual Catalog
1920-1921

With Announcements for 1921 - 1922

RAPID CITY, SOUTH DAKOTA

June 1921

Hipple Printing Company, Pierre, S. D

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COLLEGE CALENDAR

1921

Sept. 12-13,	.....	Registration.
Sept. 14,	Wednesday	First Semester begins.
Nov. 24,	Thursday	Thanksgiving Recess begins.
Dec. 23,	Friday	Christmas Vacation begins.

1922

Jan. 7,	Saturday	Christmas Vacation ends.
Jan. 23-27	.....	Midyear Examinations.
Jan. 28,	Saturday	Registration for Second Semester.
Jan. 30,	Monday	Second Semester begins.
Feb. 22,	Wednesday	Washington's Birthday.
March 27 to April 1	....	Annual Field Trips.
May 28,	Sunday	Baccalaureate Sermon.
May 29,	Monday	Final Examinations begin.
June 1,	Thursday	Commencement and Conferring of Degrees.
June 2,	Friday	Final Examinations end.

REGENTS OF EDUCATION

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THEODORE W. DWIGHT, Sioux Falls
Term expires January 1, 1921

AUGUST FRIEBERG, Beresford
Term expires January 1, 1925

FREDERICK A. SPAFFORD, Flandreau
Term expires January 1, 1925

ALVIN WAGGONER, Philip
Term expires January 1, 1927

J. O. JOHNSON, Watertown
Term expires January 1, 1927

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HELEN GAMBLE, Secretary, Frederick

W. S. O'BRIEN (State Treasurer), Treasurer Exofficio

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FREDERICK A. SPAFFORD ALVIN WAGGONER

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LL. D., Carthage College

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Professor of English

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Ph. D., Columbia University

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A. M., Harvard University

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B. C. E. University of Kentucky

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B. S. in Industrial Chemistry, Montana State College

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Director of Athletics

LL. B., University of Notre Dame

DELLA MAY HAFT

Librarian

Ph. B., University of Chicago

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Registrar and Secretary to the President

JEAN WINIFRED McCORMICK

Stenographer

CHARLES BENTLEY

Analyst, Mining Experiment Station

WILLIAM WALDSCHMIDT

Curator of the Geological Museum

B. S. in Met. E., South Dakota State School of Mines

GEORGE THOMSON

Superintendent of Buildings and Grounds

Student Laboratory Assistants.

GEORGE MAGEE ENOS, Chemistry.
WILLIAM NICHOLAS SCHULER, Chemistry.
CLARENCE GUY WURTSBAUGH, Metallurgy.
MORRIS FISHEL JACOBS, Physics.
WILLIAM MORRELL AIKMAN, Civil Engineering.
HUSTON SCHRADER, Civil Engineering.
EDWIN JOSEPH MARKVART, English.

Special Student Instructors in Mathematics.

HAROLD CHRISTENSEN, GUY MARCH, RAYMOND MARCH, MERLE PARSONS.

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Prof. McLaury
Assoc. Prof. Ackerman
Prof. Connelly
Prof. Wendt

EMERGENCIES

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Prof. Watson

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LIBRARY

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Miss Haft
Prof. Traphagen
Assoc. Prof. Ackerman

SCHOOL MAGAZINE

Prof. McLearie, Chairman
Assist. Prof. Sewell
Prof. Kammerman

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Faculty Members	Student Members
Prof. Bochert	Raymond March, '22
Prof. McLearie	Merle Parsons, '21
Pres. O'Harra	Stewart Bryant, '23

SECRETARY OF THE FACULTY

Prof. McLaury

The President of the institution is ex-officio member of all faculty committees.

Regular meetings of the Faculty are held on the first Friday of each month at 3:45 P. M.

GENERAL INFORMATION

Historical Statement

The South Dakota State School of Mines was established by the Territorial Legislature of Dakota, March 7, 1885. The first building was completed in 1886 and instruction began February 17, 1887.

The enabling act providing for the division of Dakota Territory and admitting South Dakota and North Dakota to statehood, 1889, gave to the School of Mines 40,000 acres of South Dakota lands. These lands in the earlier years showed a revenue of little importance. They now furnish considerable funds for the work of the institution but the chief income is provided through biennial appropriation by the state legislature.

The second building, the metallurgical laboratory, was completed early in 1888. The front portion of what is now the main building was erected in 1901 and to this in 1903 a rear wing was added. A heating plant was later provided and at the close of the Great War two frame buildings erected and used in connection with the training of soldiers were retained for temporary use. The legislature has made appropriation for a large new engineering building and this is now under construction. Funds were recently appropriated also for a new heating plant. The funds for this are to be available next year.

The School of Mines is under the direction of the Regents of Education. The Regents, five in number, appointed by the Governor and confirmed by the Senate have control of the various public institutions of learning maintained wholly or in part by the state as state institutions.

Location

The School of Mines is located at Rapid City the gateway to the Black Hills of South Dakota. The Black Hills region is the gem of the central northwest. Perhaps no area of equal extent in America more fittingly represents a well-selected

group of community interests. By geographic position, topographic configuration, natural resources and commercial facilities it is the controlling magnet of a great area for industry, trade and recreation.

Structurally, the region is an elliptical outwardly-dipping uplift, the more distinct features of which show a maximum extent of about 150 miles in length and 80 miles in width. The longer axis approximately coincides with the meridian except in the northern portion, where the general direction is to the northwest. Each rock unit, with its particular and sometimes striking color, yields distinctive topograhic forms, the result being that in many places features of rare interest are produced. The Harney Peak area of the southern Hills, with its bold pinnacles and shoulders of coarse, bare granite, rising from their forest-clad base of metamorphosed sedimentary rocks, presents a beautiful landscape, while the steep-walled canyons of Spearfish creek, Rapid creek and Elk creek in the Northern Hills are among the most picturesque that America can show. Again to the northwest along the upper Belle Fourche Valley, where the nearly horizontal sandstones and shales have been intricately carved by the various streams and where the brilliant and various colors of the several formations harmoniously blend with a wealth of forest and pasture overlooked here and there by the stately, sombre forms of porphyry buttes, there is presented a view well worth many a hardship to see.

The climatic conditions of the Black Hills proper are scarcely excelled anywhere in the United States. The rainfall is not heavy, but is generally sufficient and the chief precipitation comes during the planting and growing season when most needed. Aside from this, clear, mild days prevail through much of the year. Extreme cold and extreme heat are exceptional and of short duration.

In addition to the natural features of the region, the political, social, educational and moral status of the people is commendable to a marked degree. Few new countries show a greater percentage of cultured men and women interested in

the healthy advancement of a whole region and in the all-around development of every individual. Communication with all parts of the Hills is facilitated by good automobile roads, and railroads are convenient to every important district. The main lines connecting with other parts of the country are the Chicago and Northwestern railway, the Chicago, Burlington and Quincy railway, and the Chicago, Milwaukee and St. Paul railway. Rapid City is on the line of the Chicago and Northwestern connecting with Omaha, also on the line of the same road connecting with the eastern part of the state, through Pierre, and on the Chicago, Milwaukee and St. Paul connecting with the eastern part of the state through Chamberlain. It has also connection with the Burlington system by means of the Rapid City, Black Hills and Western railway from Rapid City to Mystic.

Rapid City is a growing city of about 7,000 inhabitants. It was founded in 1876 and is considered by many as the most beautifully located city in the Black Hills. It is situated on Rapid Creek 3,200 feet above sea level, and a half hour's walk takes one either out on the plains or into the hills. It offers many advantages as a college and residence city. There are eight churches, a good hospital, a fine opera house, four banks, a United States land office and weather bureau, wholesale and retail mercantile establishments, various manufacturing enterprises, many rooming houses, good hotels and enterprising newpapers. The city has also an excellent system of water works fed by springs four miles back in the hills; a modern illuminating gas works, a sewer system, and a hydro-electric plant furnishing light and power. By action of the state legislature a large new cement plant costing approximately two million dollars is soon to be erected near the city.

The people of Rapid City are interested in the welfare of the school and in addition to the usual social advantages of the place, opportunity is not infrequently given the students living elsewhere to enjoy the pleasures and influences of the best homes of the city.

The distance to the chief gold mining districts of the northern Hills near Deadwood and Lead is less than fifty miles. The mining districts of the central Hills west and southwest of Rapid City are nearer. This gives the student convenient access to active mining operations whenever desired and at the same time prevents undue distraction likely to result were the school in the midst of the hurry and hustle of mines and mills.

A particularly helpful feature, the value of which cannot well be overestimated, is the opportunity the students have for working in the mines and mills of the Hills during the summer vacations. This work following the year's schooling not only surpasses the ordinary summer mining course in the gaining of practical information, but to the energetic student, is also a source of ready cash.

The mineral products are gold, silver, lead, copper, tin, tungsten, mica, spodumene, amblygonite, fullers earth, volcanic ash, and structural material, including clay, gypsum, refinite, cement ingredients, and building stones. Lignite occurs in great quantity north and northeast of the Black Hills. This is now being mined in many places in small quantity and recent action of the legislature has provided opportunity to greatly develop the industry. The mineral production since the first mining in 1875 is approximately $280,000,000.

While the mining and metallurgical interests of the Hills are of importance, other large industries, particularly forestry, agriculture, horticulture, stock raising and manufacturing share in the fundamental occupations of the people. In connection with all this, Civil Engineering and Electrical Engineering have become of importance and the projects connected therewith now form a large field for study.

In Civil Engineering there is road making, bridge building, railroad construction, mine surveying, irrigation work and the various phases of mining and municipal problems. In Electrical Engineering there are particularly the hydro electrict and the steam electric plants for the generating of light and power for mines and metallurgical

plants, manufacturies and municipalities. Five hydro electric plants on as many different mountain streams of the Black Hills and costing more than two and a half million dollars serve to indicate the present trend of activity and to indicate the latent possibilities of our swifter streams. Several thermo electric plants are also in operation.

Buildings and Grounds

The original School of Mines building, housed for a brief time all of the class and laboratory work of the institution. It is now devoted to modern languages, biology and wood shop.

The Metallurgical building is devoted exclusively to the Departments of Mining and Metallurgy, and to the work of the State Mining Experiment Station. It contains, on the first floor, a large laboratory for advanced metallurgical chemistry, a well equipped balance room, containing massive concrete piers for the mounting of balances, chemical laboratory and supply room, assay laboratory and a large assay furnace room. In the rear of the assay furnace room is the metallurgical machinery and apparatus and storage bins for ore and fuel. On the second floor are the lecture rooms of the Departments of Mining and Metallurgy, offices of these departments, and the mining and metallurgical museum.

The Main Building is a large, brick structure, with native sandstone trimmings, three stories in height, built in two wings. This building contains, in the front wing on the first floor, a large entrance hall, the President's and Registrar's offices, lecture rooms for Mathematics and English, and the Geological Museum; also, in the rear, the Library and the Department of Geology and Mineralogy, consisting of lecture room, office, map and mineralogical store rooms, and a thoroughly equipped mineralogical laboratory. On the second floor are the Department of Chemistry and the Department of Civil Engineering. The chemical laboratories comprise the general, qualitative and quantitative laboratories, with balance room, supply rooms, lecture room and office, together with a private laboratory for the professor in charge. The rooms for

the Department of Civil Engineering consist of professor's office, two large drawing rooms, a lecture room, supply rooms and a room equipped for making blue prints. In the basement are the physical laboratories, an experimental room, lecture rooms, store rooms, a locker room, and lavatories. It is expected that considerable of the work in this building, particularly the department of Physics, Civil Engineering, and Electrical Engineering, and the classes in higher mathematics will be transferred to the new engineering building when completed.

The engineering building, the erection of which is now under way and appropriations for which, to the amount of $130,000 have been provided will add greatly to the facilities of the institution and will serve to house needed apparatus not hitherto obtainable. It is expected that this building will be available for use near the beginning of the school year, September, 1921.

The School of Mines grounds covered originally an area of ten acres. Recent purchase of adjoining land has much increased this and has opened the way for the laying out of a modern college campus.

Courses Offered

The School of Mines has from the early days of its organization maintained classes in various branches of engineering and general science. Emphasis has been placed on subjects relating to mining and metallurgy but other engineering interests, particularly those having to do with civil engineering and electrical engineering have occupied a large position in the courses given.

The institution now offers four year courses, with degrees pertaining thereto, in Mining Engineering, Metallurgical Engineering, Civil Engineering, and Electrical Engineering. Graduate courses are outlined and these lead also to appropriate degrees. A two year preparatory science course is maintained for the benefit of those who may not have had adequate high school facilities or who may be deficient in subjects required for entrance into the engineering courses.

EQUIPMENT

The institution when providing itself with apparatus endeavors to secure the most serviceable manufactured and care is taken that every piece is kept in as good condition as possible. Effort is made to see that every student has proper facilities in all of the laboratories and he is taught to realize that the grade of materials used deserve the high quality of work expected.

Chemical Laboratories.

There are four chemical laboratories in the Main Building—one for general chemistry, one for qualitative analysis, one for quantitative analysis, and a special laboratory for fuel and water analysis. The quantitative and qualitative laboratories are equipped with large indvidual desks with acid proof tops, each desk being supplied with gas from the city mains. Between the desks are sinks with flowing water. An electrolysis bench with electrical connections for electrolysis apparatus and for heating appliances is also available. The laboratories are also supplied with compressed air and with apparatus for suction. Each student receives a separate and complete set of reagent bottles and supplies. The laboratories are well lighted and provided with ample hoods to carry off fumes. The quantitative laboratory is equipped with a separate weighing room in which are analytical balances of standard makes. In addition to these laboratories there is a private laboratory for the professor of chemistry, a special dark room for spectroscopy, a dark room to be fitted for photo-chemistry, and two supply rooms from which the students get their apparatus and chemicals as needed.

The apparatus is ample for all mineral, alloy and rock analysis, as well as for research along certain lines. The special apparatus includes combustion furnaces, apparatus for gas analysis, facilities for electro-chemistry, calorimeters for fuel analysis, spectroscopes for qualitative experiments, and electroscopes for determination of radium and uranium in waters, gases, and minerals.

Physics and Electrical Engineering Laboratories

The Physics and Electrical Engineering laboratories are for the present located in the basement of the Main Building. The floors are of cement and the tables are on cement pillars, thus securing stable foundations for such apparatus and instruments as require them. The laboratory is well equipped for accurate experimental work. Among the more important pieces of apparatus are precision balances, air pumps, acceleration apparatus and Atwood machine; a variety of apparatus for specific gravity, including hydrometers, Jolly balances, Westphal balances, etc., large Steinheil spectroscope, large vernier spectrometer, precision apparatus for complete measurements in interference, diffraction, polarization and dispersion of light; apparatus for sound measurements; complete equipment for determinations of specific heat, heat of combustion, heat of vaporization, etc., complete apparatus for the determination of the mechanical equivalent of heat, seconds clock with electrical attachment; barometers, precision thermometers and pyrometers, air thermometers, Beckman thermometers; and a complete line of instruments for electrical measurements, including Weston voltmeters, ameters and wattmeters for a variety of ranges, Weston and Paul alternating current voltmeters and ammeters, Leeds and Northrup potentiometer, Leeds and Northrup precision wheatstone bridge, Kohlrausch bridge, standard condensers, Siemens electrodynamometers, Braun hot wire meters, Nalder Bros. standard inductance, Weston, Leeds & Northrup, and Cambridge Scientific Instrument Co.'s galvanometers, Braun electrometers, Dolezalek quadrant electrometer, aluminum and gold leaf electrometers and electroscopes, magnetometers, voltmeters, standard resistances; also completely equipped switch boards for both high and low voltage distribution of direct or one, two or three phase alternating current, and many special pieces of electrical apparatus, as Tesla transformers, induction coils, X-ray apparatus, spark and arc spectrum apparatus; a variety of dynamos, motors, mo-

tor-generator set, induction machines, gasoline engines and models of steam and gas engines.

The School also possesses a completely equipped wireless telegraph station consisting of a sending set of one KW capacity and sensitive receiving sets for long distance messages. Among the larger pieces of apparatus is a Westinghouse 10 K. W. rotary converter designed for many different kinds of experimental work and embodying in itself the features of a number of different electrical dynamo machines. It is designed to be operated upon either alternating or direct current and will act as a generator or as a motor. When using alternating current its operation may be one, two or three phase. Complete switchboard equipment is provided for its control in any one of its many modes of operation and includes a complete set of high grade measuring instruments for both alternating and direct current measurements. These include ammeters, voltmeters, wattmeters, power factor meters, frequency meters and dial synchroscope, all mounted on white marble panels which also carry the A. C. and D. C. circuit breakers, switches, plugs, etc. These switchboards also control a General Electric Company's 15 H. P. three phase induction motor with phase wound motor and drum control for variable speed service. This machine may be connected to the rotary converter above described by a link belt silent chain for full load tests on either machine. The equipment also includes a one K. W. motor generator set consisting of a single phase induction motor and a shunt wound generator. There are also a number of smaller A. C. and D. C. motors of various types. In addition to the above, the school heating and lighting plant and the equipment of the Departments of Mining and Metallurgy afford the student opportunity for making tests on dynamos and motors, engines and turbines of commercial sizes. The laboratory is equipped with tools and work benches for the construction of special pieces of apparatus.

Geological and Mineralogical Laboratory

This is a large room well equipped with low tables arranged for study and determination of min-

erals, rocks and fossils. Students are provided with the necessary reagents and apparatus, by the department. Each student has his own locker. A large working collection of carefully labeled minerals available for students' use is kept in specially designed cases ready of access, and a considerable collection of unknown minerals is at hand for determination. For map study there is available a complete set of U. S. Geological Survey geologic folios and a large selected collection of topographic maps.

For advanced work in mineralogy, petrography, and geology the department has a good collection of crystal models in wood and in glass, several excellent Leitz and Zeiss petrographic microscopes, and a Bausch and Lomb binocular microscope of latest type. The laboratory is also equipped with a Sauveur and Boylston polishing lathe, for the preparation of polished sections of the opaque minerals.

Biological Laboratory.

This laboratory is equipped with high class apparatus and materials. Compound and simple microscopes are provided the student for the study of forms, structures, interrelation of parts and functions and camera lucidas and a projectionscope allow for the execution of careful drawings. Several hundred thin sections of animal and plant forms are available for study and three kinds of microtomes are for use in making sections. There are also excellent anatomical models of one or more forms of the principal groups of animals, a number of imported charts showing growth habits, skeletons, including that of the human, bacterial apparatus, and a large aquarium with living forms for the study of habits, interdependence of organisms and the relation of organisms to their surroundings.

Civil Engineering Laboratories

The Civil Engineering laboratories are now in the main building but it is expected that the work of this department will be transferred to the new engineering building before the beginning of the new school year. The department is equipped with surveying instruments for all kinds of plane sur-

veying. It possesses one Gurley Y level, one Dietzgen Y level, one Berger Dumpy level, one Bausch and Lomb precision level, three Gurly transits, one with solar attachment, one Keuffle and Esser transit with Saegmuller solar attachment, one Dietzgen transit with auxiliary mining telescope, one Ainsworth transit with auxiliary mining telescope, one Bausch and Lomb mining transit, one Keuffel and Esser plane table, one Keuffel and Esser sextant, one clinometer, one planimeter, together with complete equipments of stadia rods, leveling rods, range poles, field glasses, tapes, chains, axes, etc. The topography of the lands near the school offers excellent opportunity for all kinds of field work, with every degree of difficulty from flat prairie to the most rugged of rough hill country. Testing machines of various kinds belonging to the department or in other departments are available for laboratory use.

There are two large drafting rooms—one for Freshman work, the other for Sophomore and Junior work. The rooms are well lighted and fitted with especially designed drawing desks, each desk containing lockers in which students take care of their supplies. Between the two drawing rooms there is a small room for the making of blue prints. It contains the blue print machine, sliding on a frame in the window, with south exposure so that sunlight is available for the greater part of the day. Sinks for washing blue, brown and black prints are provided.

Mining and Metallurgical Laboratories

There are two metallurgical laboratories in the Metallurgical Building; one in which are conducted metallurgical experiments as outlined in Metallurgy 405, and the other in which the various metallurgical processes are performed on a commercial scale.

The experimental laboratory is equipped with individual desks provided with gas and air; analytical and pulp balances, hot plates, and water sinks; a complete cyanide plant of ten pounds capacity, consisting of a Trojan ball mill, high pressure blower, a Pachuca agitator and filter press; a Braun

cyanide plant, a Hendryx mechanical agitator; gas and electric furnaces, pyrometers, potentiometers and platinum resistance pyrometer, Parr and Mahler-bomb calorimeters, electrical measuring instruments, etc.

The commercial laboratory is designed to illustrate chiefly the metallurgy of gold, silver, copper and lead. It is best adapted to handle ore in quantities of from three to five tons, but larger quantities may be treated if necessary.

The crushing machinery consists of a No. O Gates breaker, a pair of 16x10 inch rigid rolls, a 6x4 inch Bosworth jaw crusher, a 10x4 ft. Alsing tube mill, a 3½ ft. Huntington mill and a 3-300 lb. stamp battery and amalgamating plates.

The cyanide plant consists of two 5x3 ft. sand tanks, two 5x5 ft. slime tanks, two 4x3½ ft. solution storage tanks; two 4x3½ ft. gold solution tanks and two zinc boxes. For the agitation of slime a 10x2½ ft. Pachuca tank is used, while for slime thickening and filtration a 5 ft. Callow cone and small Moore vacuum filter are employed. The accessory apparatus for cyanidation consists of four 1½ inch centrifugal pumps, a vacuum pump, an air compressor and receiver, and three electric motors for power, etc. The above plant is extremely flexible, so that any variation from an all-sand to an all-slime process can be demonstrated on a commercial scale.

The ore dressing apparatus consists of a Traylor table, a Frue Vanner, two classifying cones, an impact screen, a Vezin sampler, and a Jarvis experimental jig.

The present oil flotation apparatus consists of a complete Callow laboratory machine, a modified Hoover machine, and a slide machine. Important additions are contemplated for the coming year.

The smelting machinery consists of a 30-inch blast furnace which may be used for either lead or copper smelting, forehearths, slag cars, and other accessories; a small Bruckner roasting furnace, and a Green rotary blower. The crushing and cyaniding and concentrating machinery is so placed that any combination of apparatus desirable may be se-

cured and practically every possible system of treatment worked out.

Assay Laboratory

The assay laboratory contains a room in which the students are provided with individual desks and pulp balances for the mixing of assay charges; a balance room provided with concrete foundation piers; the pulp room in which the ore samples are crushed and sampled; and the furnace room in which furnace work is done exclusively. This furnace room contains a gasoline assay furnace and three double muffle-furnaces, heated by soft coal. These are placed in openings in a heavy dividing wall, separating the machinery hall from the front part of the building. In this way the front of the furnaces with the muffle openings are in the furnace room, flush with the wall, while the firing and taking out of the ashes is done on the other side of the wall, thus avoiding the dust and dirt in the main work room. Large gas furnaces are available for experimental work, such as roasting, smelting, annealing, etc.

The balance room is provided with Ainsworth, Heusser, Eimer & Amend, Thompson, and Keller balances. In the pulp room an electric motor furnishes power for the small Gates sample crusher and a sample grinder. A Calkins automatic cupel machine is used for making cupels. A large number of ore samples, including ores from many parts of this country are provided in great variety, also many types of furnace products, such as mattes, flue dust, fume, and umpire sample for close checking work.

Metallographic Laboratory

This laboratory is equipped with four metallographic microscopes, microphotographic apparatus, polishnig machines, and much pyrometer apparatus, of various kinds, including potentiometer and resistance boxes. Electric furnaces are provided for heat experiments and for metallography.

Geological Museum

This museum is an important feature in the equipment of the School of Mines. Its contents

have been chosen to assist in the teaching of geology, mineralogy, petrography, and paleontology, rather than to become a storehouse of curiosities. The room has a floor area of thirty-six by forty-seven feet, is twelve feet high, and is lighted by ten large windows.

Two kinds of cases are used for the display of specimens—central cases and wall cases. There are eight central cases of oak, each consisting of two parts of three compartments each, with glazed tops, and a six compartment massive base; the whole constructed in such a manner as to serve practically as two sections, fitting tightly back to back. The display surface under glass is nearly fifty square feet for each case. The bases are especially designed for the storage of material not needed for constant exhibition.

The wall cases have glazed doors. Each is seven feet six inches high and contains three double door compartments of six shelves. The cases are particularly adapted for the display of large specimens.

Cases one to four contain a general collection of minerals arranged according to Dana's system of classification. Case seven contains a collection of well preserved fossils, carefully selected to show the more prominent features of paleontological interest. Cases five and six contain representative collections of Black Hills minerals, ores and rocks. Case eight contains Cretaceous and Tertiary fossils from the Black Hills region, mainly from the Cheyenne river and the White river Badlands.

The wall cases are for large specimens of all classes, some of which are very beautiful. The collection from the Black Hills is especially noteworthy.

The museum contains two large relief maps of the Black Hills made by E. E. Howell of Washington City for the St. Louis exposition, also a very valuable and unique ore section of the Homestake mine, donated by the Homestake Mining Company, of Lead, South Dakota. Many framed maps of mines and important geological regions adorn the

walls and serve as an added educational feature of the room.

The collection of minerals exhibited by the school at the St. Louis Exposition, 1904, received a diploma and gold medal, as did also the Black Hills relief maps.

An important supplement to the museum is the mineralogical store-room and work-room, located immediately under the museum. This room serves a triple purpose. It is a store-room for duplicate collections of Black Hills minerals and rocks. Two hundred and sixty-five bins give a storage capacity of hundreds of pounds of material. The room serves also as a work-room for the proper preparation of specimens that are to be placed in the museum. Well arranged work benches, and the necessary equipment for the examination and determination of rocks and minerals make this in effect a private laboratory for the curator of the museum, whose office is in this room.

Mining and Metallurgical Museum.

This is situated on the second floor of the Metallurgical Building, in a large,well lighted room and contains wall cases for the display of specimens. It has a fair collection of furnace products, such as slags, mattes, alloys, fuels, refractory materials, and wall boards and hoisting ropes and screens, safety lamps and models of head frames and similar materials. In time it will become a valuable adjunct to the teaching of mining and metallurgical subjects. It is added to from time to time by manufacturers and mining companies, who donate exhibits. Occasional purchases are also made.

MINING EXPERIMENT STATION

The School of Mines aims to assist the prospector, mining man and quarryman in every reasonable way in determining the nature and value of such rocks, minerals, and ores as he may have and in solving the technical problems in connection with their utilization. For many years members of the institution gave a considerable part of their services to the determination of minerals and rocks

and to the assaying, analyzing and testing of samples sent in for determination. A large amount of experimental work has been done in order to learn the most economic methods of extracting values from ores. More recently the state has appropriated money to carry on the investigations in systematic manner and this has permitted a broader scope of work. One of the professors is director of the station. There is an experienced analyst to look after the assay and analytical work and, as occasion demands, other analysts are detailed to assist him. Certain kinds of testing, especially the testing of road and building materials is cared for chiefly by members of the civil engineering department. Every effort is put forth to make the service available at little cost to all people of South Dakota who may be interested. Assays for gold and silver are made for twenty-five cents per sample. Many qualitative analyses are made free and quantitative analyses are made at as low rates as possible. Prices will be sent upon application. All samples for analysis or assay and letters accompanying the same may be addressed to the Mining Experiment Station, State School of Mines, Rapid City, South Dakota.

Library

The library occupies a well lighted room on the first floor of the Main Building, where all students may find a quiet place for study and have direct access to more than 7,500 bound volumes. Carefully selected general and scientific reference books supplement the most important standard works on Metallurgy, Mining, Geology, Chemistry, Engineering, Physics, Biology, Mathematics, English, History, Sociology, Economics, and Efficiency.

Many authoritative scientific and technical journals and transactions published by the leading societies and organizations of the United States and foreign countries, keep the library in touch with recent advancement in science. These journals are available for ready reference through the monthly periodical indexes received. Complete or nearly complete files of many of these journals may be found among the bound volumes.

The library is a repository of the documents of the United States Geological Survey, many of the state geological surveys and surveys of some of the foreign countries. The Bureau of Mines publications and other scientific bulletins of the United States government also are being received.

All students have direct access to the shelves and are thus able to make the best possible use of the library. Books commonly consulted for reference may not be removed from the room but others by special arrangement may be withdrawn for a period of two weeks. The privileges of the library are extended to those not attending the institution. Arrangement for these should be made through the librarian. The librarian will gladly assist all patrons in finding the desired information.

The following named complete sets will serve to indicate the well selected nature of the scientific and technical literature available:

	Vols.
Transactions American Institute of Mining and Metallurgical Engineers	60
Transactions British Institute of Mining Engineers	56
Engineering and Mining Journal	108
Mineral Industry	28
Coal Age	16
Concrete and Cement Age	15
Journal Iron and Steel Institute	100
Journal Institute of Metals	22
Engineering News	84
Engineering Magazine and Industrial Management	60
Engineering Index	15
Transactions American Inst. of Electrical Engineers	38
Transactions Inst. of Mining and Metallurgy	24
Journal American Chemical Society	44
Chemical Abstracts	15
Transactions American Electro Chemical Society	34
Journal Society of Chemical Industry	38
Zeitschrift fur Anorganische Chemie	57
Chemical and Metallurgical Engineering	20
Journal Industrial and Engineering Society	11

Journal Chemical, Metallurgical and Mining Society of South Africa 17
Bulletin Geological Society of America 31
Journal of Geology 28
Journal of Economic Geology 15
International Geological Congress—Special Reports on Coal and Iron 7
Physical Review 50
American Journal of Science 200
Proceedings Royal Society of London 90
U. S. Bureau of Standards 14
National Geographic Magazine 30
U. S. Geol. Survey Publications (Including Monographs, Professional Papers, Bulletins, Water Supply Papers, Mineral Resources, etc.) 400

There are also sets for general references such as:

Pooles Index of Periodicals, 1802-1906.
Readers Guide to Periodical Literature, 1900 to date
U. S. Catalog of Books in Print 1912 to date.
Congressional Document Catalog 12
National Cyclopedia of American Biography 16
Cyclopedia of Education 5

Also some of the well known historical and literary monthlies, for example:

Atlantic Monthly 126
American Review of Reviews 59
Century Magazine 100

In addition to the above there are many sets and partial sets of periodicals and atlases and maps for which there is no room here for listing. These and the many standard single volumes have been selected with care and few libraries of its size can show a better series of up to date useful volumes.

It is particularly desirable that one should early learn the value of a technical library and the purpose for which it is intended and the librarian in charge will gladly acquaint the students with the ways in which it may best be used.

PUBLICATIONS

The School of Mines issues several kinds of publications. Some of these, like the Annual Catalog and Book of Views are devoted particularly to the giving of information concerning the work of the institution. Bulletins of various lengths are issued at irregular intervals. These describe matters of a scientific, industrial, or general nature in which the people of the state may be interested. Thirteen have been published. A map of the Black Hills Region has been published. This is not only a good, general map of the country but it serves nicely as a base for use in the making of other maps. The School Magazine, The Pahasapa Quarterly, unlike the bulletins, is issued regularly and the contents vary much with conditions. The magazine has received much favorable consideration and has been published continuously for ten years. The bulletins and the magazine are described more fully below.

Bulletins. The bulletins published by the School of Mines are issued in serial number, the last being Number 13. Commonly they are distributed free to those interested but for Number 13 there is a nominal charge. In the case of the other numbers the supply of copies is practically or quite exhausted. The bulletins as issued are as follows:

Bulletin No. 1—Preliminary Report of the Dakota School of Mines upon the Geology, Mineral Resources and Mills of the Black Hills of Dakota; 171 pages. 1888. By F. R. Carpenter and H. O. Hofman. **(Out of Print.)**

Bulletin No. 2—Notes on the Geology and Mineral Deposits of a Portion of the Southern Black Hills; 41 pages, 1899. By C. C. O'Harra and A. Forsyth.

Bulletin No. 3—Cyanide Experiments on the Siliceous Ores of the Northern Black Hills, etc.; 27 pages. 1900. By A. Forsyth and G. H. Clevenger.

Bulletin No. 4—Two papers: A History of the Early Explorations, and of the Progress of Geological Investigation in the Black Hills Region; and

A Bibliography of Contributions to the Geology and Geography of the Black Hills Region; 88 pages. 1900. By C. C. O'Harra. **(Out of Print.)** For later and more complete bibliography see Bulletin No. 11.

Bulletin No. 5—The Cyanide Process in the Black Hills of South Dakota; 88 pages. 1902. By C. H. Fulton. **(Out of Print.)**

Bulletin No. 6—The Mineral Wealth of the Black Hills; 88 pages. 1902. By C. C. O'Harra. **(Out of Print.)**

Bulletin No. 7—Metallurgical Practice in the Black Hills of South Dakota; 63 pages. 1904. By C. H. Fulton.

Bulletin No. 8—The Cement Resources of the Black Hills; 55 pages. 1908. By C. C. O'Harra, M. F. Coolbaugh, M. A. Ehle, Jr., and C. H. Fulton.

Bulletin No. 9—The Badland Formations of the Black Hills Region; 152 pages. 1910. By C. C. O'Harra. **(Out of Print.)** See also No. 13.

Bulletin No. 10—The Minerals of the Black Hills; 200 pages. 1914. By Victor Zeigler. **(Out of Print.)**

Bulletin No. 11—A Bibliography of the Geology and Mining Interests of the Black Hills Region; 225 pages. 1917. By C. C. O'Harra.

Bulletin No. 12—The Occurrence, Chemistry, Metallurgy and Uses of Tungsten with Special Reference to the Black Hills of South Dakota. By J. J. Runner and M. L. Hartmann, including a Bibliography of Tungsten by M. L. Hartmann. 264 pages. 1918.

Bulletin No. 13—The White River Badlands. 181 pages and 96 plates. 1920. By C. C. O'Harra. Price fifty cents and postage.

The Pahasapa Quarterly—This magazine, the first number of which was issued in December, 1911, is published by the faculty and students of the institution. The subscription price is $1.00 per year. Free to students. As the name indicates, it appears four times during the school year and is devoted to the interests of the School of Mines and the Black Hills region. It con-

tains articles of interest to engineers generally and to the students and alumni of the School of Mines especially.

The magazine has contained many papers of timely importance and several times a special number has dealt almost entirely with one particular subject, for example, the Tungsten number, the Northern Black Hills number, the Manganese number, the Petroleum number, the Lignite number, the Good Roads number, and the Students Army Training Corps number. The following individual papers serve to illustrate the general nature of the articles presented.

Climatic Characteristics of the Black Hills.

Lithium, Its Occurence, Uses, Determination and Methods of Extraction.

Water Power Possibilities of the Black Hills.

Tin, Occurrence in the Black Hills and Methods of Analysis.

Radium and Its Geological Significance.

Limitations of the Fire Assay.

Notes on Molybdate and Sulphate Methods for Determination of Lead.

Mill Construction and Costs.

Flotation of Minerals.

An Investigation of the Irrigation Possibilities of Little Elk Creek.

An Investigation of the Extraction of Potash from Feldspar.

Cambrian Blue Siliceous Ores of the Black Hills.

The Angostura Irrigation Project.

The Belle Fourche Dam and Irrigation Project.

The Homestake Mine.

The Golden Reward Roaster.

The Viscosity of Blast Furnace Slags at High Temperature.

Flotation of Gold Ore.

Metallurgy and the War.

The Geology of Petroleum Deposits.

Oil Well Drilling.

The Refining of Petroleum.

The Engineer in War.

The Engineer After the War.

Lignite Coals and Their Utilization.

Sampling and Analyzing Coal.
The Origin of Peat.
The Origin of Coal.
Roads: Past, Present, Future.
The Largest Known Beryl Crystal.
The Field for Research in Nonferrous Metallography.
Water Pool Calcite, An Interesting Cave Mineral.
Columbite Crystals from the Black Hills.
The Importance of Testing Materials in Engineer's Construction.

STUDENT ACTIVITIES

Students' Association.—The student body has always maintained one or more organizations for the direction of student activities. Recently, in order to better correlate these activities, the Students' Association was formed. As stated in the Constitution, the object of the Association, is to provide a representative body of students which, by virtue of the position of influence of its members, in student affairs, shall be able to supervise and control all non-academic activities of the student body as a whole; second, to bring about a closer union of student organizations and to establish a more effective control of non-academic student affairs; third, to provide a suitable medium through which student opinion may be presented to college authority and the opinion of the college authority may be presented to the students.

Engineering Societies.—Two engineering societies provide opportunity for social and intellectual entertainment among the higher classmen. These are the Drill and Crucible Club affiliated with the American Institute of Mining and Metallurgical Engineers, and the School of Mines Club of the American Association of Engineers. Commonly technical papers are presented at the meetings either by the students or by others invited in for the purpose.

Musical Organizations.—It has been the custom to organize an orchestra and a glee club for such students as are musically inclined. During

the past year a number of the students interested in band music organized a band and this proved a highly enjoyable and useful feature of the student life. There is no charge to the student for instruction in any of these organizations, his activity fee covering all costs.

Athletics.—The institution heartily encourages athletics within proper limits. An all school year athletic director is provided and the students are trained to the various kinds of sports common to college life. There is football in the autumn, basket ball in the winter, and track athletics in the spring. Good tennis courts are conveniently placed on the campus and these are available through much of the year.

The School of Mines organized and directs the Black Hills Annual Field Meet. This is held in May and is open only to high school contestants. School of Mines trophy cups and badges are awarded.

STUDENT EXPENSES

Tuition, Fees and Free Scholarships

The State of South Dakota from the very beginning has endeavored to make it possible for every young man and young woman in the state to get an education without burdensome expenditure. The charge for tuition is a merely nominal sum for all the higher institutions and fees are reduced to a minimum. Furthermore, there are several provisions by which residents of the state may secure remission of the tuition fee and under certain circumstances laboratory fees as well as tuition. The Regents of Education under direction of the State Legislature are authorized to establish the fees. The fundamental regulation in regard to charges as given in Section 5576 of the Revised Code of 1919, page 1326, is as follows:

"Except as otherwise expressly provided in this code the board shall fix all rates of tuition and other fees to be paid by students, but such rates shall be the same in all institutions for the same instruction. It may receive in any one of the institutions under its control, free of tui-

tion, two students appointed by each state senator, and one by each representative of the state legislature, which appointees shall be residents of their respective districts or counties, and whose terms shall expire with the term of office of such senator or representative; provided, that such appointees shall comply with all the rules and requirements of the institutions which they desire to enter. No student, however, shall receive any other gratuity."

Any student wishing to secure the benefits of the scholarships above named should at the time of registration present a written appointment from his senator or representative. Otherwise, the fee will be collected in cash and no refund will be made. The Registrar, upon application will furnish an official blank for the purpose.

The legislature in the 1919 regular session amended Section 5577 of the Revised Code so as to provide Free Tuition for residents of the state who have seen military service. Part of this enactment is as follows:

"Section 5577: Tuition Free-Veterans). Any person residing in this state, who has served in the army or navy of the United States during any war in which the United States has been engaged, including members of the South Dakota National Guard, who performed military service outside of the borders of this state, and has been honorably discharged from such service, has been furloughed into any reserve branch of the military or naval service of the United States, or who performed active war service such as nursing or assisting in the care of soldiers and sailors in any government hospital, field or camp, as a member of the Red Cross or any other similar organization engaged in war relief work, which shall have been recognized and approved by the government of the United States, during any of the periods herein before mentioned, shall upon complying with all the other requirements for admission be entitled to attend and pursue any course or courses in any state educational institution, under the control and management of the Board of Regents of this State, without the payment of charges for tuition. It shall be the duty of the Board of Regents to determine who are entitled to the benefits of this act. The term "honorably discharged" shall be construed to include the terms, "good discharge' and 'release from active service'."

The Regents of Education, in order to accommodate in so far as possible South Dakota young people who show special aptitude for a higher education, have recently provided free scholarships, one for the highest ranking young man from each accredited four year high school in the state and one for the highest ranking young woman. The regulations governing the awarding of these free scholarships are as follows:

"To the highest ranking young man and young woman of good moral character, graduating from any accredited four-year high school in South Dakota, shall be awarded free scholarships in the State University, the State College of Agriculture and Mechanic Arts, the State School of Mines, or in any of the State Normal Schools of the State. These scholarships shall afford free tuition and fees, except breakage charges, dormitory rent, and such deposits as may be required for the return of the equipment lent to the student, for any course or courses in these institutions, and shall in no case exceed $60 in one fiscal year.

"Scholarships are not transferable from individual to individual, but upon the satisfactory completion of a year's work in one institution, may be transferred to another institution. A student transferring from one institution to another shall take with him the original copy of his scholarship, with his attendance record at the institution he is leaving endorsed thereon, and certified by the President or Registrar of the institution he is leaving. Scholarships may be withdrawn temporarily or permanently for misdemeanor or for failure or condition in any subject.

"Should any highest ranking high school graduate be unable or unwilling to accept a scholarship for any given year, in any institution, public or private, it may be awarded to the graduate next highest in rank requesting it. A student waiving the privilege of scholarship for any given year may claim it for any succeeding year or years but in no case shall more than one scholarship for a young man and one for a young woman be awarded to any high school graduating class.

"Special blanks are provided for students wishing to apply for scholarships.

"This regulation shall not apply to any student who graduated before the close of the school year 1920-21."

Students other than those receiving free tuition are charged tuition and fees as follows:

General

Tuition per semester .....$ 6.00
Fee for Bachelor's Degree 5.00
Fee for Advanced Degree 10.00
Fee for "Conditioned" Examination 2.00

Laboratory Fees

Chemistry 101, General and Qualitative .....$5.00 per semester
Chemistry 102, General and Qualitative .....$5.00 per semester
Chemistry 201, Quantitative Analysis .....$6.00 per semester
Chemistry 203, Organic ..$10.00 per semester
Chemistry 204, Organic ..$10.00 per semester
Chemistry 301, Metallurgical Chemistry .....$6.00 per semester
Metallurgy 302, Assaying ..$5.00 per semester
Metallurgy 405, Pyrometry $5.00 per semester
Metallurgy 408, Cyaniding $5.00 per semester

Student Activity Fee.

A fee of $5.00 per semester is required of all students in order to meet the expenses attendant upon student activities. The Students' Association has charge of these activities and they include athletics, debates, oratorical contests, et cetera. The student is entitled to participation in or attendance upon games, contests and other entertainments provided by the Students' Association, and to subscription to the school magazine the Pahasapa Quarterly.

Breakage and Instrument Deposits

Chemistry 101 and 102, General and Qualitative .....$5.00 per year
Chemistry 201 and 202, Quantitative Analysis .....$5.00 per year
Chemistry 203 and 204, Organic $5.00 per year
Chemistry 301, Metallurgical $5.00 per semester
Civil Engin. 101 and 102, Engin. Drawing .....$10.00 per year
Civil Engin. 201 and 202, Plane Surveying .....$5.00 per year
Metallurgy 302, Assaying $20.00 per semester

Metallurgy 405, Pyrometry..$5.00 per semester
Metallurgy 408, Cyaniding $10.00 per semester
Mineralogy 301 and 302, General and Determinative .....$5.00 per year

Students are expected to pay all fees and deposits in advance and until this is done registration cannot be completed nor can classes be entered. In view of the fact that the tuition and fees are small for the benefits received reductions cannot be made for a fraction of a semester, nor will tuition, incidental, or laboratory fees be refunded. (Rules and Regulations of the Regents' Board, Section 25.) The unused portion of laboratory deposits will be refunded at the close of the school year.

Late Registration.—Students who do not register during the regular registration days will be charged an extra fee not to exceed $1.50.

Incidental Expenses

Students are required, at various times, to take part in the local geological, mining and metallurgical field trips. The geological trips of the Freshman year usually cost the student about $10. The surveying trips in the Sophomore year will cost about $12. Trips in the Junior and Senior year, for mining and metallurgical exploration, cost a similar sum. Students taking Engineering Drawing are required to provide their own drawing instruments. The price for a set of these varies from $12.00 to $16.00.

Living Expenses

Students will find living expenses in Rapid City approximately the same as in other parts of the country. In order to lessen these expenses as much as possible, the School of Mines maintains a dining hall in which meals are served at cost. Effort will be made to keep the charges for the coming year as near the earlier figures as market conditions will allow. Rooms may be obtained in the city with private families or in boarding houses or hotels.

The officers of the institution endeavor to aid students in securing suitable and satisfactory rooming places. It is expected that no student will occupy rooms not properly approved.

Opportunities for Self Help

Opportunity for self help in a city the size of Rapid City is necessarily limited. The growth of the place however is such as to keep up a considerable demand for help of many kinds and almost any worthy, industrious student can find employment. It is to be borne in mind that the course of study is an arduous one and requires the student's best effort, and if conscientiously and satisfactorily performed, will leave comparatively little outside time in which to earn money.

Some students find employment which nets them their board and lodging by doing chores in private families or assisting in some of the stores, shops, mills, or manufacturing plants. Some find employment in the boarding houses. The school is able to assist a few students, to some extent, by employing them in the capacity of assistant janitors and similar work.

Students who have become ecquainted, by a residence in town for a year or two, find it easier to obtain work than strangers. For this reason it is essential that a student who comes as a stranger to enter the school should be provided with sufficient funds to carry him through the first year, at the very least.

REQUIREMENTS FOR ADMISSION

Freshman Class

Requirements for admission to the Freshman class are as follows:

Fifteen units are necessary for entrance.

Required Units

Algebra	1.5	units
Plane Geometry	1	unit
Solid Geometry	0.5	unit
English	3	units
History	1	unit
Physics	1	unit
Chemistry	1	unit
Total required units	9	units

Elective Units

French	1, 2 or 3	units
German	1, 2 or 3	units
Latin	2, 3 or 4	units
Greek	1	unit
Spanish	1 or 2	units
English	1 or 2	units
History	1 or 2	units
Algebra	0.5	units
Science	1 or 2	units
Drawing	1	unit
Shop Work	1	unit
Civil Government	0.5	unit
Bookkeeping	1	unit
Elective units required for entrance	6	units

A unit course of study is defined as a course covering a school year of 36 weeks with 5 periods of at least 45 minutes each per week. Proficiency of study in all courses in the School of Mines is recorded as follows: A equals 94 to 100, B equals 86 to 93, C equals 78 to 85, D equals 70 to 77, E equals 60 to 69, F is failure. Inter semester grades are recorded twice each semester as follows: October 22, December 10, March 11, May 6.

Methods of Entering the School

Graduates of accredited High Schools in the state of South Dakota and other states will be provisionally admitted without examination, if they present proper credentials, certifying to the fact that they have completed the studies mentioned under the requirements for admission. It will be a service to the registration committee if new students will forward their credentials to the registrar before time for entrance.

Other candidates for admission will be given credit for so many of the fifteen necessary units as they may bring credentials for, and will be permitted to make up the remainder in the classes maintained as outlined below to meet the requirements of students entering without having had adequate High School facilities. Formerly these covered four full years. Only the third and fourth years are now given. These years correspond

pretty closely to the last two years of the best high schools but more emphasis is placed on subjects leading to scientific and technical careers.

The School of Mines faculty has direct supervision of the work. Two instructors devote practically their entire time to the department and others teach one or more subjects. The same laboratory facilities are afforded these students as are enjoyed by the higher classes.

Application blanks for entrance will be sent on request.

PREPARATORY SCIENCE COURSE

Third Year

First Semester—	Hours per Week Lectures	Lab.
Biology 1—General Biology ...	3	3
English 5	5	..
French 1	5	..
Mathematics 3—Geometry	5	..
	18	3

Second Semester—	Lectures	Lab.
Biology 2—General Biology	3	3
English 6	5	..
French 2	5	..
Mathematics 4—Geometry	5	..
	18	3

Fourth Year

First Semester—	Hours per Week Lectures	Lab.
*Biology 3—Zoology or	3	3
*French 3 or *English 7	5	..
Chemistry 1	3	6
Mathematics 5—Geometry	5	..
Physics 1	4	6
	17 or 15	12 or 15

Second Semester—	Lectures.	Lab.
*Biology 4—Botany or	3	3
*French 4 or *English 8	5	..
Chemistry 2	3	6
Mathematics 6—Algebra	5	..
Physics 2	4	6
	17 or 14	12 or 15

*The student may select one of the three courses.

Admission to Advanced Standing

Graduates of colleges and technical schools who enter the school as candidates for a degree will receive proper credit for all such studies which they have completed and which form part of the curriculum of the School of Mines. The faculty decides these cases upon the basis of individual merit.

General Studies

The South Dakota School of Mines is frequently approached by students, both men and women, who have no wish to become engineers but who seek to enlarge their mental horizon by taking some of the subjects of more general interest offered in the several courses. To all such persons the School of Mines extends a cordial welcome and offers every facility at its disposal for their cultural benefit. The attention of persons so minded is called to the following list of subjects, all taken from the regular courses, which have a general educational value: English literature, foreign language—including French, German (Not given at present), and Spanish—history, sociology, economics, mathematics, biology, geology, mineralogy, chemistry, physics, astronomy, drawing and by special arrangement civics and history. From these subjects a course may easily be selected corresponding to the first two or three years of a general college curriculum. Every effort will be made to give satisfactory attention to special students taking work along any of these lines. The only fees charged are the usual tuition and students' activities fees and such laboratory fees as may be required in courses taken.

Special Students

Applicants for admission, who are graduates of colleges or technical schools will be admitted as special students and permitted to take any subject they desire, taught in connection with the regular courses. Persons of mature age, who have been employed in engineering plants and who desire to take up special courses pertaining to their particular work, will be admitted as special students, provided they show that they have sufficient foundation to properly take up the work.

Summer School

The summer school in surveying begins immediately after commencement and is arranged especially to accommodate students who are completing the sophomore year. The electrical engineering students spend two weeks in plane surveying, the mining and metallurgical engineering students spend two weeks in plane surveying and one week in underground mine surveying, and the students in civil engineering spend three weeks in surveying as outlined in the civil engineering course. Every effort is exerted to make this work practical and instructive. The mine surveying is done in a suitable mine in the Black Hills, the remainder of the work is done in the vicinity of Rapid City.

Degrees

The school of Mines offers degrees as follows: Bachelor of Science in Mining Engineering, to the candidate who has successfully completed the regular Mining Engineering Course; Bachelor of Science in Metallurgical Engineering, to the candidate who has successfully completed the Metallurgical Engineering Course; Bachelor of Science in Civil Engineering to the candidate who has successfully completed the Civil Engineering Course; and Bachelor of Science in Electrical Engineering to the candidate who has successfully completed the Electrical Engineering Course.

Advanced degrees are conferred upon candidates of the corresponding engineering course of the institution who have devoted one year at gradu-

ate study in the School of Mines, under the direction of the faculty, passing required examinations upon the studies pursued, or those who shall furnish evidence of two years successful experience in technical work, and who submit an adequate thesis, the thesis being duly considered and accepted by the faculty before such advanced degree will be granted.

Candidates for the advanced engineering degree should make application for such not later than December 1st of the school year in which graduate work is begun.

In order to allow time for correspondence and corrections, the thesis of a non-resident candidate should be submitted not later than April 15th of the year in which the degree is to be granted. This thesis should be typewritten on paper 8½x11 inches in size. Two copies must be furnished; one for the department within which the thesis falls and one for the library.

The following is a list of some of the theses that have been submitted. This includes also theses formerly required of undergraduates.

Arentz, S. S. Some Experiments on Bromo-Cyanogen.

Hall, Arthur E. Some Features Illustrating the Quantitative Chemistry of the National Smelter Blast Furnaces.

West, Elmer W. Notes on Assay Slags.

Anderson, O. A. The Grand View Mining Property with Plan and Estimated Cost of Development Work and Reduction Plant.

Coolidge, E. B., and Gaines, Wm. N. The Metallurgical Treatment of Ore from the Queen Bee Property.

Curran, H. T. and O'Brien, B. D. Experiments on the Blue Ores of the Back Hills.

Read, John B. The Distribution of Gold and Silver in the Siliceous Ores of the Black Hills.

Seiter, Herbert, and Penhoel, L. C. Some Suggestions Relative to the Development of the Grand View Mining Property Near Silver City.

Smith, E. V. L. Development of a Low Grade Mining Property, Kittilas County, Washington.

Wetherald, Fred H. The Determination of Formation Temperatures of Certain Silicates.

Whytock, Peter R. Preliminary Notes on Some Supposed Nickeliferous Minerals of the Black Hills.

Bryant, Frank. An Investigation of the Different Cyanide Methods, as Applied to the Treatment of the Black Hills "Blue" Ores.

Ellerman, Otto. The Gordelia Mining Company of Rochford, South Dakota.

Matson, B. V., and Anderson, F. B. Report on the Hematite and Delaware Mines, Including Metallurgical Treatment.

Morris, Milton, and Cornel, W. L. Experiments on Slag Losses Due to Borax Glass.

Van Nuys, C. C. Plane Curves.

Wells, L. P., and Whitmore, C. F. Report on Coolgarde Group of Claims, Ida Gray Mining District.

Coolidge, Cyril, and Overpeck, Lem S. The Iron Deposits of the Black Hills of South Dakota.

Goodner, Ivan E. (With Professor C. H. Fulton.) The Constitution of Copper-Iron and Copper-Lead-Iron Mattes.

Ives, Glen P., and Ossa, Ignatio D. Metallurgical Treatment of Jamesonite Ores.

Sparling, Wm., and Winters, F. W. A Hypothetical Mine.

Betterton, J. O. The Determination and Separation of Antimony and Arsenic.

Coolidge, Roy F. The White Precipitates Found in Zinc Boxes.

Jones, H. W., Hvistendahl, E. S., and Read, H. N. The Standby Mine.

Ledyard, L. W. The Cleopatra Mine.

Eddy, John W., and Bennett, R. T. A Hypothetical Mine.

Jeffries, Zay, and Wheelock, H. E. Economic Resources of the Badlands.

Sargent, A. E., and Flower, G. E. The Development of a Hypothetical Mine and the Metallurgical Treatment of the Ore.

Saville, Joseph H. The Possible Development of the Deep Down Property and Treatment of Its Ore.

Stoner, J. W., and Elliot, J. W. A Hypothetical Mine.

Anderson, Wm. L. Investigation of White Precipitate in Zimmerman-Reinhart Method for Iron.

Brooks, Floyd R. Investigation Concerning the Melting Points of a Series of Copper Slags.

Ehle, Chester G. Gypsum Deposits and the Stucco Industry in the Black Hills.

Quinney, E. H., and Winsor, F. H. Jr. Cyanide Tests on a Refractory Siliceous Ore of the Northern Black Hills.

Willard, C. G., and Muhmel, F. J. Investigations of Fire Clays Near Rapid City.

Fahrenwald, Frank A. Report on the Rapid Valley Irrigation Project.

Anderson, Amil A. On the Cambrian Blue Siliceous Ores of the Black Hlls.

Alder, Alfred. Experiments with the Quantitative Analysis of Lead.

Hartgering, J. M. Design of a Cement Plant.

Henton, Hugh M. Some Experiments in Analysis of Titanium, Magnesium, Zinc.

Bochert, W. C. Metallurgical Treatment of a Typical Refractory Siliceous Ore.

Eldridge, Robert B. Experiments in Ore Flotation.

Fahrenwald, Arthur W. Report on the Metallurgical Investigation of a Blue Ore.

Farnham, Lloyd L. Experiments on the Fine Grinding and Amalgamation of Jamesonite Ores.

Fleischman, Leo. Data on the Relative Fuel Consumption of Oil and Coal Fired Muffle Furnaces.

Hill, Robert S. Notes on Beryllium.

McCauley, Willard J. An Investigation of the Irrigation Possibilties of Little Elk Creek.

Meents, R. O. Leaching a Copper Ore.

Pryer, W. C. Investigation for a Volumetric Determination for Arsenic.

Stowell, George E. The Geology of Silver City and Vicinity.

Booth, L. E., and Thiel, Arthur. Electrolysis of Alkaline Solutions of Potassium Sulpho-cyanide.

Gates, C. E. The Design of a Plant for a Southeastern Missouri Lead Mine.

O'Harra, B. M. The Gold-Bearing Quartz-Tremolite Series of the Black Hills.

Cragin, Rodney S. Tests for Gold and Silver of the Country Rock of the Black Hills.

Dennis, Paul Joseph. Experiments in Making Brick from the Graneros and Pierre Shales.

Hill, Joseph Henry. The Refining and Recovery of Gold from Dental Scrap.

Smith, Elwyn L. Radio-active Minerals of the Black Hills.

Anderson, Amil. Homestake Stamp Mill Practice.

Bochert, Wm. C., and Price, Virgil T. Flotation of a Gold-Bearing Schist Ore.

Cremer, Frank. Burnt Gumbo and Its Adaptability for Improving the Highways of South Dakota.

Deutsch, Harry. The Metallurgical Treatment of Jamesonite Ore.

Clark, Edwin Espy. Some Changes in the Operating Characteristics of a 10 KW Synchronous Converter, Due to the Reduction of the Air-Gap.

Newbowers, Frank Joseph. Hydro-Electric Development for Farm Installation.

Stout, Herbert A. Experiments in the Treatment of an Arsenopyrite Concentrate.

Wong, Yu Chih. The Electric Treatment of Antimony. (Stibnite Sb_2S_3 from Gillham, Arkansas.)

Nelson, Harold Lee. Some of the Fundamentals Observed in the Improvement of Our Highways

Hall, Ralph Julius and Mara, Hubert Wilber. The Utilization of Columbium.

Johnson, J. Harlan. The Caves of the Black Hills.

Waldschmidt, W. A. A Study of Columbite with Special Reference to the Black Hills Deposits.

COURSES AND DEPARTMENTS

All engineering courses offered by the School of Mines require four years for completion. They are as follows: Mining Engineering, Metallurgical Engineering, Civil Engineering, and Electrical Engineering.

MINING ENGINEERING COURSE

Freshman Year

	Cred. Hrs.	Hours per Week Lect.-Lab.
First Semester—		
Math. 101—Trigonometry	5	(5-0)
Chem. 101—Gen. and Qualitative	6	(4-6)
English 101—Rhetoric	4	(4-0)
C. E. 101—Engineering Drawing	2	(0-6)
Shop 101—Woodwork	1	(0-3)
	18	(13-15)
Modern Language, Optional	3	(3-0)

Second Semester—		
Math. 102—Analyt. Geometry	5	(5-0)
Chem. 102—Gen. and Qualitative	6	(4-6)
English 102—Rhetoric	4	(4-0)
C. E. 102—Engineering Drawing	2	(0-6)
Shop 102—Turning, Pattern Making	1	(0-3)
	18	(13-15)
Modern Language, Optional	3	(3-0)

Sophomore Year

First Semester—		
Math. 201—Dif. Calculus	4	(4-0)
Physics 201—General	5	(4-3)
Geology 201—General	4	(3-3)
C. E. 201—Plane Surveying	3	(2-3)
Shop: 201—Forge and Foundry	1	(0-3)
Chem. 201—Quant. Analysis	4	(2-6)
	21	(15-18)
Modern Language, Optional	3	(3-0)
Second Semester—		
Math. 202—Integr. Calculus	4	(4-0)
Physics 202—General	5	(4-3)
Geology 202—General	4	(3-3)
C. E. 202—Plane Surveying	3	(2-3)
Shop 202—Machine Shop	1	(0-3)
Chem. 202—Quant. Analysis	4	(2-6)
	21	(15-18)
Modern Language Optional	3	(3-0)

Junior Year

First Semester—		
Economics 301	3	(3-0)
Met. 301—General Metallurgy	3	(3-0)
Mining 301—Breaking Ground	2	(2-0)
Mining 303—Ore Dressing	4	(3-3)
C. E. 301—Topographic Mapping	1	(0-3)
C. E. 206—Field Work, Surveying	1	(0-3)
C. E. 303—Applied Mechanics	3	(3-0)
Mineralogy 301—General	4	(2-6)
	21	(16-15)

Second Semester—		
Economics 302	3	(3-0)
Met. 302—Assaying	4	(1-9)
Mining 302—Tunnel, Shaft Sinking	2	(2-0)
Mining 304—Ore Dressing	4	(3-3)
C. E. 304—Strength Materials	5	(4-3)
Mineralogy 302—Determinative	4	(2-6)
	22	(15-21)

Senior Year

First Semester—		
Met. 401—Gold and Silver	2	(2-0)
Met. 403—Copper	3	(3-0)
Mining 401—Drain. Transportation	2	(2-0)
Mining 403—Exploitation	3	(3-0)
C. E. 403—Graphic Statics	1	(0-3)
C. E. 405—Struct. Details	1	(0-3)
Geology 401—Econ. Geology	4	(4-0)
Electives	4	(2-6)
	20	(16-12)
Second Semester—		
Met. 304—Iron and Steel	3	(3-0)
Met. 408—Cyanide Test	2	(0-6)
Mining 402—Comp. Air	2	(2-0)
Mining 404—Ventilation, Light	3	(3-0)
Mining 406—Mining Design	1	(0-3)
Geology 402—Econ. Geology	4	(4-0)
Electives	4	(2-6)
	19	(14-15)

METALLURGICAL ENGINEERING COURSE

Freshman Year

		Hours per Week
First Semester—	Cred. Hrs.	Lect.-Lab.
Math. 101—Trigonometry	5	(5-0)
Chem. 101—Gen. and Qual.	6	(4-6)
English 101—Rhetoric	4	(4-0)
C. E. 101—Eng. Drawing	2	(0-6)
Shop 101—Woodwork	1	(0-3)
	18	(13-15)
Modern Language Optional	3	(3-0)

Second Semester—		
Math. 102—Analyt. Geometry	5	(5-0)
Chem. 102—Gen. and Qualitative	6	(4-6)
English 102—Rhetoric	4	(4-0)
C. E. 102—Engineering Drawing	2	(0-6)
Shop 102—Turning, Pattern Making	1	(0-3)
	18	(13-15)
Modern Language Optional	3	(3-0)

Sophomore Year

First Semester—		
Math. 201—Dif. Calculus	4	(4-0)
Physics 201—General	5	(4-3)
Geology 201—General	4	(3-3)
C. E. 201—Plane Surveying	3	(2-3)
Shop 201—Forge and Foundry	1	(0-3)
Chem. 201—Quant. Analysis	4	(2-6)
	21	(15-18)
Modern Language Optional	3	(3-0)
Second Semester—		
Math. 202—Integr. Calculus	4	(4-0)
Physics 202—General	5	(4-3)
Geology 202—General	4	(3-3)
C. E. 202—Plane Surveying	3	(2-3)
Shop 202—Machine Shop	1	(0-3)
Chem. 202—Quant. Analysis	4	(2-6)
	21	(15-18)
Modern Language Optional	3	(3-0)

Junior Year

First Semester—		
Economics 301	3	(3-0)
Met. 301—General Metallurgy	3	(3-0)
Mining 301—Breaking Ground	2	(2-0)
Mining 303—Ore Dressing	4	(3-3)
Chem. 301—Met. Chemistry	5	(2-9)
Mineralogy 301—General	4	(2-6)
	21	(15-18)

Second Semester—		
Economics 302	3	(3-0)
Met. 302—Assaying	4	(1-9)
Met. 304—Iron and Steel	3	(3-0)
Mining 302—Tunneling	2	(2-0)
Mining 304—Ore Dressing	4	(3-3)
Mineralogy 302—Determinative	4	(2-6)
	20	(14-18)

Senior Year

First Semester—		
Met. 401—Gold and Silver	2	(2-0)
Met. 403—Copper	3	(3-0)
Met. 405—Pyrometry, etc.	2	(0-6)
Chem. 401—Electro-chemistry	2	(2-0)
Mining 401—Drainage	2	(2-0)
Modern Lang. Spanish	3	(3-0)
Electives	7	(7-0)
	21	(19-6)
Second Semester—		
Met. 404—Non-ferrous metals	5	(5-0)
Met. 406—Electro-metallurgy	2	(2-0)
Met. 408—Cyanide testing	2	(0-6)
Mining 402—Compressed air	2	(2-0)
Modern Lang. Spanish	3	(3-0)
Electives	6	(6-0)
	20	(18-6)

CIVIL ENGINEERING COURSE

Freshman Year

	Hours per Week Cred. Hrs.	Lect.-Lab.
First Semester—		
Math. 101—Trigonometry	5	(5-0)
Chem. 101—Gen. and Qualitative	6	(4-6)
English 101—Rhetoric	4	(4-0)
C. E. 101—Engineering Drawing	2	(0-6)
Shop 101—Woodwork	1	(0-3)
	18	(13-15)
Modern Language Optional	3	(3-0)

Second Semester—		
Math. 102—Analyt. Geometry	5	(5-0)
Chem. 102—Gen. and Qualitative	6	(4-6)
English 102—Rhetoric	4	(4-0)
C. E. 102—Engineering Drawing	2	(0-6)
Shop 102—Turning, Pattern Making	1	(0-3)
	18	(13-15)
Modern Language Optional	3	(3-0)

Sophomore Year

First Semester—		
Math. 201—Dif. Calculus	4	(4-0)
Physics 201—General	5	(4-3)
Geology 201—General	4	(3-3)
C. E. 201—Plane Surveying	3	(2-3)
Shop 201—Forge and Foundry	1	(0-3)
C. E. 203—Descript. Geometry	2	(0-6)
	20	(14-18)
Modern Lang. Opt.	3	(3-0)
Second Semester—		
Math. 202—Integr. Calculus	4	(4-0)
Physics 202—General	5	(4-3)
Geology 202—General	4	(3-3)
C. E. 202—Plane Surveying	3	(2-3)
Shop 202—Machine	1	(0-3)
C. E. 204—Higher Surveying	2	(1-3)
	20	(15-15)
Modern Language Optional	3	(3-0)

Summer School

C. E. 206—Surveying (Mine and Topographic) one week. One hour lecture daily, and six hours field work, which is the equivalent of 18 lecture hours or 54 laboratory hours and therefore, equals one credit.

Junior Year

First Semester—		
Economics 301—General	3	(3-0)
E. E. 301—D. C. Elect. Engineering	3	(3-0)
Mining 301—Breaking Ground	2	(2-0)
Met. 301—General	3	(3-0)

C. E. 301—Topog. Mapping	1	(0-3)
C. E. 303—Applied Mechanics	3	(3-0)
C. E. 305—R. R. Engineering	2	(1-3)
E. E. Lab. 351—D. C. Machines	1	(0-3)
Electives	2	(2-0)
	20	(17-9)
Plus 1 from summer	1	
	21	

Second Semester—

Economics 302—General	3	(3-0)
E. E. 302—A. C. Engineering	3	(3-0)
Mining 302—Tunneling	2	(2-0)
Met. 304—Iron and Steel	3	(3-0)
C. E. 304—Strength of Materials	5	(4-3)
C. E. 306—Astronomy and Geodesy	2	(1-3)
E. E. Lab. 352—A. C. Machines	1	(0-3)
Electives	2	(2-0)
	21	(18-9)

Senior Year

First Semester—

C. E. 401—Hydraulics	3	(3-0)
C. E. 403—Graphical Statics	1	(0-3)
C. E. 405—Struct. Details	1	(0-3)
C. E. 407—Bridge Stresses	3	(3-0)
C. E. 409—Concrete Construction	3	(3-0)
C. E. 411—Roads and Pavements	4	(3-3)
Biology 401—Sanitation and Public Health	3	(2-3)
Electives	3	(3-0)
	21	(17-12)

Second Semester—

C. E. 402—Water S. and Water P.	4	(4-0)
C. E. 404—Sewerage	2	(2-0)
C. E. 406—Drain. and Irrigation	3	(3-0)
C. E. 408—Bridge Design	2	(0-6)
C. E. 410—Masonry Construction	3	(2-3)
C. E. 412—Contracts and Specifica.	2	(2-0)
C. E. 414—C. E. Seminar	2	(2-0)
Electives	3	(3-0)
	21	(18-9)

ELECTRICAL ENGINEERING

Freshman Year

	Cred. Hrs.	Hours per Week Lect.-Lab.
First Semester—		
Math. 101—Trigonometry	5	(5-0)
Chem. 101—Gen. and Qualitative	6	(4-6)
English 101—Rhetoric	4	(4-0)
C. E. 101—Engineering Drawing	2	(0-6)
Shop 101—Woodwork	1	(0-3)
	18	(13-15)
Modern Language, Optional	3	(3-0)
Second Semester—	Cr.	R-L
Math. 102—Analytic Geometry	5	(5-0)
Chem. 102—Gen. and Qualitative	6	(4-6)
English 102—Rhetoric	4	(4-0)
C. E. 102—Engineering Drawing	2	(0-6)
Shop 102—Turning, Pattern Making	1	(0-3)
	18	(13-15)
Modern Language, Optional	3	(3-0)

Sophomore Year

First Semester—		
Math. 201—Dif. Calculus	4	(4-0)
Physics 201—General	5	(4-3)
Geology 201—General	4	(3-3)
C. E. 201—Plane Surveying	3	(2-3)
Shop 201—Forge and Foundry	1	(0-3)
C. E. 203—Descript. Geometry	2	(0-6)
	19	(13-18)
Modern Language, Optional	3	(3-0)
Second Semester—		
Math. 202—Integr. Calculus	4	(4-0)
Physics 202—General	5	(4-3)
Geology 202—General	4	(3-3)
C. E. 202—Plane Surveying	3	(2-3)
Shop 202—Machine Shop	1	(0-3)
E. E. 202—Introduction to E. E.	3	(2-3)
	20	(15-15)
Modern Language, Optional	3	(3-0)

Junior Year

First Semester—		
Economics 301	3	(3-0)
C. E. 303—Applied Mechanics	3	(3-0)
Mech. E. 301—Thermodynamics	3	(3-0)
E. E. 303—Elect. and Magnetism	3	(3-0)
E. E. 305—D. C. Engineering	3	(3-0)
E. E. 307—Teleph. and Telegraph	2	(2-0)
E. E. Lab. 303—E. and Magn. Meas.	2	(0-6)
E. E. Lab. 355—D. C. Laboratory	2	(0-6)
	21	(17-12)
Second Semester—		
Economics 302	3	(3-0)
C. E. 304—Strength of Materials	5	(4-3)
Mech. E. 302—Steam Boilers	2	(2-0)
E. E. 304—Elect. and Magnetism	3	(3-0)
E. E. 306—A. C. Theory	3	(3-0)
E. E. Des. 376—D. C. Design	1	(0-3)
E. E. Lab. 354—Adv. E. and Mag. Meas.	2	(0-6)
E. E. Lab. 356—Adv. D. C. Lab.	2	(0-6)
	21	(15-18)

Senior Year

First Semester—		
Mech. E. 401—Steam Eng. and Turbines	3	(2-3)
C. E. 401—Hydraulics	3	(3-0)
E. E. 401—Adv. A. C. Theory	3	(3-0)
E. E. 403—Illumination	3	(2-3)
E. E. Lab. 451—A. C. Lab.	4	(0-12)
	16	(10-18)

5 Credits must be elected from the following:

E. E. 405—Elect. Railways	2	(2-0)
E. E. 407—Dist. and H. T. Transm.	3	(3-0)
E. E. Des. 475—A. C. Design	2	(0-6)
Free Electives	4	
Second Semester—		
C. E. 412—Specif. and Contracts	2	(2-0)
Chem. 206—Fuel, Water and G. An.	3	(1-6)
E. E. 402—Advanced A. C. Theory	3	(3-0)
E. E. 404—Seminar	2	(2-0)

E. E. 406—Elect. Cent. Stations.....	3	(3-0)
E. E. 412—Inspection Trip	1	(...)
E. E. Lab. 452—Adv. A. C. Lab.	2	(0-6)
	16	(11-12)

6 Credits must be elected from the following:

E. E. 408—Wireless Telegraph	2	(2-0)
E. E. 410—Meter Test and Stand....	3	(2-3)
E. E. 414—Thesis.....	4	(0-12)
Free Electives.....	5	

CHEMISTRY

Professor Bisson. Assistant Professor Sewell.

The courses in Chemistry are designed to give engineering students a knowledge of the principles of Chemistry most essential to their work. The subject is presented in all courses according to the modern chemical theories. The purpose is to create an interest in experimentation and to show the proper classification of experimental data according to the general principles studied, as well as to develop accuracy and precision in manipulation.

Chemistry 1. Elementary Inorganic Chemistry

First Semester. Three lecture hours and six laboratory hours per week.

Prerequisite. None.

Course. Required of all students desiring further work in chemistry and who do not present high school chemistry as entrance credit.

Text. Brownlee's Principles of Chemistry. Brownlee's Laboratory Exercises in Chemistry

The work in this course consists of demonstrated lectures and laboratory work, experiments on the elements and the compounds they form; elementary chemical laws and calculations.

Chemistry 2. Elementary Inorganic Chemistry

Second semester. Three lectures hours and six laboratory hours per week.

Prerequisite. Chem. 1.

Course: Required of all students desiring further work in Chemistry and who do not present

high school chemistry as entrance credit. Continuation of Chemistry 1.

Chemistry 101. General Chemistry
6 Credits.

Freshman Year, First Semester. Four lecture hours and six laboratory hours per week.

Prerequisite. Chemistry 1 and 2 or one year high school chemistry.

Course: Required of all Freshmen.

Text: Hildebrand's Principles of Chemistry. Bray and Rosensteins Laboratory Manual of General Chemistry.

This course consists of a study of the fundamental theories and laws which are necessary for a thorough understanding of proceedures in Qualitative and Quantitative Analysis. Experiments illustrating the gas laws, stoichiometric calculations, chemical equilibrium, oxidation and reduction, ionization, indicators, etc., are carried out in the laboratory.

Chemistry 102. Qualitative Analysis
6 Credits.

Freshman Year, Second Semester. Four lecture hours and six laboratory hours per week.

Prerequisite: Chemistry 3.

Course: Required of all Freshmen.

Text: Alex Smith's Inorganic Chemistry. A. A. Noyes, Qualitative Chemical Analysis.

This course takes up a study of occurence and preparation of the elements, together with their physical and chemical properties. The work in the laboratory consists of a systematic separation and detection of the metals and the non-metals.

Chemistry 201. Quantitative Analysis
4 Credits.

Sophomore Year, First Semester . Two lecture hours and six laboratory hours per week.

Prerequisite: Chemistry 101 and 102.

Required of all Sophomores in the Metallurgical and Mining Engineering Courses.

Text: Blasdale. Principles of Quantitative Analysis.

This course consists of a study of the general principles used in quantitative analysis, and includes the analysis of a number of simple substances by entirely gravimetric methods. The theory and facts which form the basis for the experimental work are discussed and a number of problems involving chemical calculations are solved.

Chemistry 202. Quantitative Analysis
4 Credits.

Sophomore Year, Second Semester. Two lecture hours and six laboratory hours per week.

Prerequisite: Chemistry 201.

Required of all Sophomores in the Metallurgical and Mining Engineering courses.

Text: Blasdale. Principles of Quantitative Analysis.

This course is a continuation of Chemistry 201 and includes the analysis of a number of substances by volumetric methods. The experimental work is supplemented with discussions of the theory and facts concerned in the proceedures and also with problem work.

Chemistry 203. Organic Chemistry
4 Credits.

Sophomore Year, First Semester. Two lecture hours and six laboratory hours per week.

Prerequisite: Chemistry 102.

Elective course in Chemistry.

Text: Bernthsen & Sudborough, Organic Chemistry. Laboratory Manual Cohen, Practical Organic Chemistry.

Lecture and laboratory work dealing with the chemistry of the Carbon Compounds.

Chemistry 204. Organic Chemistry
4 Credits.

Sophomore Year, Second Semester.

Prerequisite: Chemistry 203.

Elective Course in Chemistry.

Continuation of Chemistry 203.

Chemistry 301. Advanced Quantitative Analysis (Metallurgical Chemistry)

5 Credits.

Junior Year, First Semester. Two lecture hours and nine laboratory hours per week.

Prerequisite: Chemistry 202.

Required of all Juniors in the Metallurgical Engineering Course.

Text: Lord and Demorest Metallurgical Chemical Analysis; Reference Text; Scott Standard Methods of Chemical Analysis.

This course is a continuation of the work in Chemistry 201 and 202 and includes a study of the practical analytical methods used in Metallurgical inductries for the analysis of ores, alloys and furnace products, and for the analysis of the rare elements found in the minerals of the Black Hills. Reference is made to the analytical methods described in the Chemical Journals as well as to those presented in the standard texts.

Chemistry 303. Physical Chemistry

2 Credits.

Junior Year, First Semester. Two lecture hours per week.

Prerequisite: Chemistry 202, Physics 202, Mathematics 202.

Elective for students in the Metallurgical Engineering couse.

Text: Washburn's Principles of Physical Chemistry.

A number of the important principles of physical chemistry are studied from the standpoint of their application to problems of the chemist and metallurgist. The lectures are supplemented with problem work.

Chemistry 304. Physical Chemistry

2 Credits.

Junior Year, Second Semester. Two lecture hours per week.

Prerequisite: Chemistry 303.

Elective for students in Metallurgical and Mining Engineering Courses.

Continuation of course 303.

Chemistry 401. Electro-Chemistry

2 Credits.

Senior Year, First Semester. Two lecture hours per week.

Prerequisite: Chemistry 202, Physics 202, Mathematics 202.

Required of all Seniors in the Metallurgical Engineering Course.

Text: Allmand, Principles of Applied Electro Chemistry.

This course deals with the theories and facts upon which Electro-Chemical processes are based.

Chemistry 206.—Technical Analysis—Fuel, Water, Oils, Etc.

2 Credits.

Senior Year, Second Semester. One lecture hour and six laboratory hours per week.

Prerequisite: Chemistry 102.

Required of all students in the Electrical Engineering Course.

Elective for others.

Text: Lord and Demorest, Metallurgical Chemical Analysis.

This course is intended primarily for engineers and takes up the proximate analysis and determination of the calorific value of fuels, the viscosity, flash point, burning point of lubricating oils, the analysis of fuel gases, and boiler water analysis.

Chemistry 450

Chemical Research: Opportunity will be given for original research along chemical lines.

CIVIL ENGINEERING

Professor Wendt.

The instruction in civil engineering is given by means of lectures and recitations; by actual practice in the field, in the laboratory, and in the drafting room; by library reference work; by inspection trips to near-by engineering projects; and by participation of the student in the programs of the technical societies and the department seminar.

The aim of the department is to give the student in civil engineering such training in fundamental principles as will properly fit him for entrance to the profession of civil engineering, and to train the students in mining, metallurgical and electrical engineering in such subjects of civil engineering as may be necessary for the successful practice of their respective professions.

Drafting Rooms. The department occupies drafting rooms adapted to the successful prosecution of its work; one room for freshman drawing, one room for sophomore descriptive geometry and plotting surveys, and one room for upper class design. The drafting rooms are furnished with suitable drafting desks and tables, which have separate lockers for each student. Students taking courses in drawing should provide themselves with the following supplies, most of which may be obtained from the supply room of the department at cost:

One set of drawing instruments (to be approved by the head of the department).

One T-square with 30 inch blade.
One 7-inch 30 degree by 60 degree triangle.
One 8-inch 45 degree triangle.
One 12-inch engineer's scale.
One 5-inch protractor.
One irregular curve.

Drawing paper, pencils, ink, erasers, etc., as needed.

Drawing boards are furnished by the school. Every student registering in a course in drawing makes a deposit of $5.00, to cover the return of the drawing board, and the purchase of supplies. Any unexpended amount of deposit is returned upon the completion of the subject or the student leaving school.

Surveying Equipment. The surveying equipment consists of 7 transits, 4 levels, 1 precise level, 1 plane table, 1 sextant, 1 Burt solar attachment, 1 Saegmuller attachment, numerous hand levels, level rods, stadia boards, range poles, tapes, slide rules, computing machines, 1 planimeter, 1 clinometer, 1 pair field glasses and the usual auxiliary

equipment. Each student taking surveying makes a deposit of $5.00 to cover breakage and loss of equipment.

Cement Testing Laboratory. The cement testing laboratory is equipped for making standard tests upon cement and upon concrete aggregates. This equpiment consists of a tension machine; Vicat apparatus; Gillmore needles; specific gravity flasks; electric drying oven; soundness steamer; moist closet; fineness scale; sand scale; triple beam balance; Harvard trip balance; several sets of standard sieves; and a supply of gang molds, trowels, graduates, and the necessary smaller equipment.

Road Materials Testing Laboratory. The road materials testing laboratory is equipped to make physical tests upon sand, gravel, and stone to determine the fitness of their use in road construction. The equipment consists of one Deval abrasion machine, one ball grinding mill, one cementation briquette former, one impact machine for cementation, one set of stone screens, one Troemner solution scale, and other smaller auxiliary apparatus.

Civil Engineering 101.—Engineering Drawing
2 Credits.

Freshman Year. Six hours drafting per week.
Prerequisites: None.
Required of all Freshmen.
Text: French's Engineering Drawing.

Instruction is given in the selection, care, and use of drawing instruments, simple geometric constructions, lettering, orthographic projections and sections and developed surfaces and intersections. The actual drafting room work is supplemented by lectures as needed.
needed.

Civil Engineering 102. Engineering Drawing.
2 Credits.

Freshman Year. Six hours drafting per week.
Prerequisite: C. E. 101.
Required of all Freshmen.

Text: French's Engineering Drawing.

Continuation of C. E. 101, and includes pictorial methods of representation, working drawings, mechanical details, perspective drawings, architectural and isometric drawings, structural details, plotting land surveys, topographic symbols, tracing and blue printing.

Civil Engineering 201. Plane Surveying

3 Credits.

Sophomore Year. Two hours of lecture and recitation and three hours of field work per week.

Prerequisite: C. E. 101 must precede or accompany, and Trigonometry.

Required of all Sophomores.

Text: Breed and Hosmer's Surveying, Vol. 1.

This is the beginning course in plane surveying and includes linear measurements, use, care, and adjustment of engineer's transit, level, and plane table, traversing, methods of land surveying, leveling computations for area, computations for earthwork, plotting and principles of stadia methods.

Civil Engineering 202. Plane Surveying.

3 Credits.

Sophomore Year. Two hours of lecture and recitation and three hours of field work per week.

Prerequisite: C. E. 201.

Required of all Sophomores.

Texts: Breed and Hosmer's Surveying, Vol. 1; Durham's Mine Surveying.

Continuation of C. E. 201 and includes the applications of surveying methods to topographic surveying, mine surveying, determination of meridians by direct solar observation and observation of Polaris. The following subject matter under Mine Surveying is covered: location and patent survey of mineral claims, carrying meridian underground via vertical and inclined shafts, underground traversing and leveling, underground connections, measurements of ore reserves and stope volumes, note taking and plotting.

Civil Engineering 203. Descriptive Geometry
2 Credits.

Sophomore Year. Six hours drafting per week.
Prerequisite: C. E. 102 and Solid Geometry.
Required of Sophomores in Civil Engineering and Electrical Engineering.
Text: Higbee's Essentials of Descriptive Geometry.
Instruction is carried on by means of drafting room practice supplemented by lectures and recitations, and includes shades and shadows and problems involving the point, line, and plane, the generation, classification and intersection of curves and surfaces.

Civil Engineering 204. Higher Surveying
2 Credits.

Sophomore Year. One hour recitation and three hours field work per week.
Prerequisite: C. E. 202 must precede or accompany.
Required of Sophomores in Civil Engineering.
Text: Breed and Hosmer's Surveying, Vol. 1.
A course for students in civil engineering designed to supplement C. E. 202 and to place greater emphasis upon the problems of surveying of interest and importance to the civil engineer. Includes city surveying, elementary railroad curves and vertical curves.

Civil Engineering 206. Field Surveying
1 Credit.

Sophomore Year. One hour lecture daily and six hours field work daily, for one week of summer school immediately following the close of the sophomore year.
Prerequisite: C. E. 202.
Required of Sophomores in Civil Engineering and Mining.
Actual practice in mine surveying and topographic surveying. Complete surveys are made and the field notes are used for mapping in the succeeding course.

Civil Engineering 301. Topographic Mapping
1 Credit.

Junior Year. Three hours drafting per week.
Prerequisite: C. E. 206.
Required of Juniors in Civil Engineering and Mining.

Conventional signs used in representing topography, mapping, and profile work. The notes taken in the preceding summer's field work are worked up in the drafting room, and the course concludes with a complete topographic map.

Civil Engineering 303. Applied Mechanics
3 Credits.

Junior Year. Three hours lecture and recitation per week.
Prerequisite: Math. 202 and Physics 202.
Required of Juniors in Civil Engineering and Electrical Engineering and Mining.
Text: Poorman's Applied Mechanics.

Fundamental principles of statics and dynamics are developed. The work is intended to be of a highly practical character based on a sound theoretical training. The following topics are covered: composition and resolution of forces; conditions of equilibrium; center of gravity; moment of inertia; laws of motion; friction; work; energy and power. Analytic methods are employed, supplemented by graphic constructions and numerous problems of practical application.

Civil Engineering 304. Strength of Materials
5 Credits.

Junior Year. Four hours of lecture and recitation, three hours laboratory per week.
Prerequisite: C. E. 303.
Required of Juniors in Civil Engineering, Electrical Engineering and Mining.
Text: Boyd's Strength of Materials, Cambria Steel Handbook.

The strength, resistance and elasticity of materials of engineering construction, including tension, compression, and shear; riveted joints, torsion; and the transmission of power; flexure of beams; stresses in columns; design of columns;

and combined stresses. The laboratory work covers tension, compression, shearing and bending tests upon specimens of iron, steel, wood, and concrete. These include standard commercial tests, and tests to determine the elastic properties of materials. Standard tests are made upon cement and the coarse aggregates of concrete.

Civil Engineering 305. Railroad Engineering
2 Credits.

Junior Year. One hour lecture and recitation, three hours field work per week.

Prerequisite: C. E. 202.

Required of Juniors in Civil Engineering.

Text: Raymond's Elements of Railroad Engineering.

Theory and practice of preliminary and location surveys; track construction; maintenance and operation; easement curves and earthwork; yards and terminals; and the elementary principles of economic location.

Civil Engineering 306. Astronomy and Geodesy
2 Credits.

Junior Year. One recitation hour and three hours field work per week.

Prerequisite: C. E. 204.

Required of Juniors in Civil Engineering.

Text: Breed and Hosmer's Surveying, Vol. 2.

A brief course in the elements of engineering astronomy. The use of the transit for the determination of time, latitude, azimuth and meridian; base line measurements; triangulation; methods of precise leveling and adjustments of observations.

Civil Engineering 401. Hydraulics
3 Credits.

Senior Year. Three hours of lecture and recitation per week.

Prerequisite: C. E. 303.

Required of Seniors in Civil Engineering and Electrical Engineering.

Text: Slocum's Elements of Hydraulics.

A study of hydraulics as a continuation of the courses in engineering mechanics. The course in-

cludes hydrostatics, hydrodynamics, water supply, water power. and hydraulic mchinery. Special attention is given to the flow of water in pipes as preparatory to the design of a distributing system of a municipal water supply and the handling of water for a hydro-electric power development. The school is favorably situated for field work in hydraulics. Rapid Creek is a mountain stream with a fall of about 1.6%, offering splendid facilities for weir measurements. Two large irrigation ditches are adjacent to the school, and Rapid City has three water-power plants within the city limits. The students thus have opportunity to visit and study hydraulic power plants in successful operation.

Civil Engineering 402. Water Supply and Water Power

4 Credits.

Senior Year. Four hours lecture and recitation per week.

Prerequisite: C. E. 401.

Required of Seniors in Civil Engineering.

Text: Folwell's Water Supply Engineering, Meade's Water Power Engineering.

The application of hydraulics to water supply engineering in municipalities, and the study of the design, construction, maintenance, and operation of a distributing system. Methods of purification are also taken up. A design of a distributing system of a city of 10,000 population is made by each student.

Civil Engineering 403. Graphic Statics

1 Credit.

Senior Year. Three hours drafting per week.

Prerequisite: C. E. 304.

Required of Seniors in Civil Engineering and Mining.

Text: Malcolm's Graphic Statics.

The principles of statics by graphic methods. Graphical solutions are made of the stresses existing in a number of typical forms of roof and bridge trusses and head frames; also determination of stresses in beams under moving loads.

Civil Engineering 404. Sewerage

2 Credits.

Senior Year. Two hours lecture and recitation per week.

Prerequisite: C. E. 401.

Required of Seniors in Civil Engineering.

Text: Folwell's Sewerage.

A study of the design, construction and maintenance of sewerage systems, and the treatment and disposal of sewage. Each student completes a design for a city of 5,000 inhabitants and makes estimates of cost.

Civil Engineering 405. Structural Details

1 Credit.

Senior Year. Three hours drafting per week.

Prerequisite: C. E. 304.

Required of Seniors in Civil Engineering and Mining.

Text: Cambria Steel Handbook, Howe's Design of Simple Roof Trusses in Wood and Steel.

A course dealing with drafting room methods applicable to the elements of structural details. Use of the steel handbook in the designing and detailing of elementary roof and bridge trusses and head frames. Stresses are determined both by graphic and algebraic methods.

Civil Engineering 406. Drainage and Irrigation

3 Credits.

Senior Year. Three hours lecture and recitation per week.

Prerequisite: C. E. 401.

Required of Seniors in Civil Engineering.

Texts: Elliot's Engineering For Land Drainage. Newell and Murphy's Principles of Irrigation.

The application of engineering principles to the design and construction of drainage and irrigation works; the design of irrigation structures and the operation of irrigation projects; a study of drainage from the standpoint of reclamation.

Civil Engineering 407. Bridge Stresses

3 Credits.

Senior Year. Three hours lecture and recitation per week.

Prerequisite: C. E. 304 and must be accompanied by C. E. 403.

Required of Seniors in Civil Engineering.

Text: Merriman and Jacoby's Roofs and Bridges, Part 1.

A study of the methods for the determination of stresses in roofs, bridges and girders under a variety of loadings. Complete algebraic analyses are made for highway truss bridges, a railroad truss bridge and a plate girder for use in the design of these structures the following semester.

Civil Engineering 408. Bridge Design

2 Credits.

Senior Year. Six hours drafting per week.

Prerequisite: C. E. 405 and 407.

Required of Seniors in Civil Engineering.

Text: Merriman and Jacoby's Roofs and Bridges, Part 3.

Complete detailed drawings are made of a highway bridge, a railroad bridge and a plate girder from the computations in Bridge Stresses of the preceding semester.

Civil Engineering 409. Concrete Construction

3 Credits.

Senior Year. Two hours lecture and recitation per week.

Prerequisite: C. E. 304.

Required of Seniors in Civil Engineering.

Text: Hool's Reinforced Concrete Construction, Vol. 1.

The mechanics of elementary reinforced concrete structures including slabs, beams, girders and columns. Considerable time is devoted also to the study of cement and the aggregate, and to proper methods of proportioning, mixing and handling.

Civil Engineering 410. Masonry Construction

3 Credits.

Senior Year. Two hours lecture and recitation, three hours drafting per week.

Prerequisite: C. E. 304.

Required of Seniors in Civil Engineering.

Text: Baker's Masonry Construction.

A study of masonry materials, such as building stone, brick, cement, concrete and their application for use in engineering structures. The drafting room practice includes the design of foundations, abutments, dams, retaining walls and culverts. A complete investigation of reinforced concrete arch is made, using the elastic theory.

Civil Engineering 411. Roads and Pavements
4 Credits.

Senior Year. Three hours lecture and recitation, three hours laboratory per week.

Prerequisite: C. E. 202 and 304.

Required of Seniors in Civil Engineering.

Text: Agg's Construction of Roads and Pavements.

The principles of the location, construction and maintenance of suburban roads and city pavements; materials, methods and economics. The laboratory work includes the examination and physical testing of non-bituminous road materials.

Civil Engineering 412. Contracts and Specifications
2 Credits.

Senior Year. Two hours lecture and recitation per week.

Prerequisite: Economics 1.

Required of Seniors in Civil Engineering and Electrical Engineering.

Text: Johnson's Engineering Contracts and Specifications.

A brief course in the study of the law of contracts and engineering specifications. Practice in the preparation of contracts and specifications.

Civil Engineering 414. Seminar
2 Credits.

Senior Year. Two hours lecture and recitation per week.

Open only to seniors.

Required of Seniors in Civil Engineering.

Assembly of engineering students for the purpose of discussion upon recent developments of general engineering practice, and professional culture and ethics. Collateral reading, papers, reports, discussion, investigation and inspection trips.

ECONOMICS

Professor McLearie

These courses are designed to facilitate the adaptation of the young engineer to the business conditions which he will encounter in his practical work in the field. The importance of business training for engineers is manifested by the increasing demand for the graduates of technical schools who have a knowledge of the fundamentals of business.

Economics 301. Principles of Economics
3 Credits.

Three lecture hours per week.
Junior year.
Required of all Juniors.
Juniors.

Text Books: Ely's Outline of Economics; Fetter's Economic Principles; Turner's Introduction to Economics.

This course gives a brief survey of the principles of economics. It traces the history of economic development and studies the facts and forces in our present economic organization. It is designed to meet the needs of students whose work lies in professional department, particularly engineering.

Economics 302. Principles of Economics
3 Credits.

Junior year.
Required of all Juniors.
Three lecture hours per week.

This course is supplementary to Economics 301. It includes discussions of the more important contemporary economic problems. The emphasis is placed upon the consideration of such topics as: Industrial Combinations and Monopolies, Labor and Labor Organizations and Corporation Finance.

Economics 303. Accounting
2 Credits.

Elective: Juniors and Seniors.
Two hours of lecture and recitation per week.

An introductory course in the elements of accounting. It is of particular value to engineering students, laying the foundation for further application of this subject in technical work.

Economics 304. Business Law

2 Credits.

Elective: Juniors and Seniors.

Two hours of lecture and recitation per week.

A study of the law relating to a particular kind of business. The course includes contracts; negotiable instruments; partnerships; private corporations.

Economics 401-402. Business Organization and Management

3 Credits per Semester.

Elective: Seniors.

Three hours of lecture and recitation per week.

Prerequisites: Economics 303 and 304.

A consideration of the underlying principles of organization and management and their application to engineering projects. A brief study will be made of general methods of business organization of staff; relation between workers and management; standardizing operations; purchasing and general store room methods.

Economics 501-502

3 Credits per Semester.

Three lecture hours per week.

Prerequisites: Economics 301-302.

Elective.

These courses are designed to give the student an intensive knowledge of some one field of modern economic principles, as well as to give training in the gathering and correlation of material. For 1921-1922, the special subject considered will be "Problems of Labor and Employment."

Sociology 301.

3 Credits.

Elective for Juniors and Seniors.

Three lecture hours per week.

Text Book: Blackmar and Gillin's Outlines of Sociology.

This course is introductory in character. It consists of lectures and required reading on the contents and methods of Sociology. The physical, biological and psychological aspects of social evolution are discussed.

Sociology 302.

3 Credits.

Elective for Juniors and Seniors.

Three lecture hours per week.

This course is a continuation of Sociology 301. It also includes a study of social problems and reform movements. As far as practical, particular attention is directed to the social aspects of business and public affairs.

Sociology 401-402.

3 Credits per Semester.

Prerequisites: Sociology 301-302.

Elective.

Three lecture hours per week.

These courses aim to give the student an opportunity to make a critical study of some modern social problems. For 1921-1922 the topic discussed will be "Radical Social Theories."

ENGLISH

Professor McLearie.

The aim of this department is to give the student a command of good idiomatic English and to aid him in the development of the Art of expression. Special emphasis is laid upon the importance of good composition in technical work. Attention is called to the absolute necessity that every professional man should be able to express his thoughts with clearness and accuracy.

English 5-6 and 7-8

These courses cover a study of the principles of writing. They include punctuation, letter and business forms, analysis of models, writing of compositions, and study of American and English literature with particular reference to English classics. The

courses are available to those who may be deficient in entrance requirements. They cover five lecture periods each per week.

English 101.

4 Credits.

Freshman Year.
Four lecture hours per week.
Required of all Freshmen.
Text Books: Canby's English Composition; Steeves and Ristine's Representative Essays in Modern Thought; Eason and Wesseen's English Science and Engineering.

The Elements of Effective Writing: This course gives both theoretical and practical instruction. The theory is taught by class room work based on standard text books. The practice is obtained by exercises, written in the class room, and by weekly themes. At least one theme a week is required and every theme is returned to the student to be revised and rewritten.

English 102.

4 Credits.

Freshman Year.
Four lecture hours per week.
Prerequisite: English 101.
Required of all Freshmen.

This course supplements the work of the first semester by giving further practice in narrative, expository and argumentative writing. A study is made of the works of such authors as will aid in practical composition work. Three themes are required each containing from 800 to 1,000 words. There are conferences on each theme.

English 201-202.

4 Credits Each.

Elective: Sophomore year.
Two lecture hours per week.
Prerequisite: English 101-102.

Advanced Composition: This course is for students who wish additional practice in descriptive and narrative writing. The course will be accompanied by readings in modern prose.

English 301-302.
3 Credits each Semester.

Elective: Juniors or Seniors.
Three lecture hours per week.
Prerequisite: English 101-102.
Technical Composition: This course is designed to give an opportunity for a careful study of the application of the principles of expository writing. Reviews are made of current technical periodicals, and published reports.

ELECTRICAL ENGINEERING

Professor Kammerman

The work in this department has been planned to meet the needs of those wishing a thorough, theoretical and practical foundation for electrical engineering. For a thorough training, the fundamental principles and laws of electricity and magnetism are first studied by means of text-books and laboratory exercises involving electrical measurements. Upon this foundation more advanced problems involving the design of direct and alternating current apparatus, electrical distribution systems, and high tension transmission systems, are taken up. Special attention is called to the economic features involved in engineering problems. Specialization is permitted in the senior year along one of the several optional lines of study. Seniors are required to take an inspection trip, comprising several days for the purpose of studying manufacturing and operating methods as they are carried out in practice along electrical engineering lines.

The New Engineering Building in which the Electrical Engineering department is housed, affords excellent opportunity for laboratories of most modern design. Power is received from the local power company at 2200 volts, three phase A. C. It is reduced to 110 volts and distributed throughout the laboratory by means of an eight panel switchboard from which numerous circuits radiate to many points in all the laboratories. A 35 K. W. motor generator set furnishes direct current power for the

electrical department and also all other departments on the campus.

The main dynamo laboratory is situated on the basement floor. This laboratory contains single, and polyphase alternating current motors and generators, direct current motors and generators, transformers of standard design and also for Scott two to three phase connection, a Mercury arc rectifier and a rotary converter.

By means of the switchboards, the various machines and apparatus may be interconnected. Trunk lines run from the main switchboard to the various secondary switchboards in the other laboratories, so that students are able to interconnect any desired combination of machines and instruments. This laboratory is well equipped with accessory apparatus for instructional work, such as instruments, rheostats, dynamometers and brakes.

The laboratory on the first floor is devoted to Standardizing and Calibrating, Photometry, and Telephone and Telegraph work. For work in standardizing, a Leeds & Northrup Type K potentiometer is used as a primary standard and a Weston Standard Laboratory voltmeter, and Standard Laboratory ammeter are used as secondary standards. A rotating standard is available for calibrating watthour meters. For conducting photometric and illumination work, the usual photometers are available. A Foot-candle meter is a recent addition to this laboratory. Many lamps and reflectors are available for experimental work. For the telephone and telegraph work, a collection of transmitters, receivers, induction coils, bells, jacks, drops, keys, etc., are available for the assembly of telephone and telegraph circuits.

A large lecture room is used for recitation and lecture work, electrical design, and as a calculation room.

The Electrical Engineering Department has charge of the School of Mines Radio Station. The station is completely equipped with up to date sending apparatus and two complete receiving sets. One of these is for arc, or continuous waves, and

has a guaranteed receiving radius of 9,000 miles. The other is for spark, or damped wave, signals. This is intended for shorter range than the other, but messages have been copied from all parts of the United States with it.

Effort is made to keep in step with the most recent developments in this relatively new branch of electrical work and new apparatus is being added as needed to keep it up to date.

Electrical Engineering 202. Introduction to Electrical Engineering.

3 Credits.

Sophomore year, two recitation and lecture hours per week and one computation period.

Prerequisite: Math. 201 and Physics 201.

Required of Sophomore Electrical Engineers.

The work in this course consists of a review of the various systems of units and the relations between the systems. The principles of Ohm's Kirchhoff's, Joule's and Coulombe's laws are studied and problems based on these laws are solved.

Electrical Engineering 301. Direct Current Engineering.

3 Credits.

Junior year. Three recitation and lecture hours per week.

Prerequisite, Math. 202.

Required of Junior Civil Engineers, elective for Junior or Senior Mining and Metallurgical Engineers.

This course is devoted to the study of the fundamental theory of electric and magnetic circuits, the principles of construction and operating characteristics of direct current machines, and the industrial applications of each.

Electrical Engineering 302. Alternating Current Engineering.

3 Credits.

Junior year. Three recitation and lecture hours per week.

Prerequisite E. E. 301.

Required of Junior Civil Engineers, elective for Junior and Senior Metallurgical Engineers.

This course is devoted to the study of the fundamental theory of alternating current circuits, the principles of construction and operating characteristics of alternating current machines and transformers, and the industrial applications of each.

Electrical Engineering 303. Electricity and Magnetism.

3 Credits.

Junior year. Three recitation and lecture hours per week.

Prerequisites: Physics 202 and Math 202.

Required of Junior Electrical Engineers.

This course consists of a mathematical treatment of the theory of Electricity and magnetism.

Electrical Engineering 304. Electricity and Magnetism.

3 Credits.

Three recitation and lecture hours per week.

Prerequisite: E. E. 303.

Required of Junior Electrical Engineers.

This course is a continuation of the work given in E. E. 3.

Electrical Engineering 305. Direct Current Engineering.

3 Credits.

Junior year. Three recitation and lecture hours per week.

Prerequisite: E. E. 202.

Required of Junior Electrical Engineers.

The work in this course covers the theory of the magnetic circuit, the characteristics and operation of direct current generators and motors, and their efficiencies and practical applications.

Electrical Engineering 306. Alternating Current Theory

3 Credits.

Junior year. Three recitation and lecture hours per week.

Prerequisite: E. E. 305.

Required of Junior Electrical Engineers.

The work in this course covers the fundamental theory of alternating current circuits and the

fundamental theory governing the operation and construction of the alternating current generator, induction motor and transformer.

Electrical Engineering 307. Telephones and Telegraph.

2 Credits.

Senior year. Two recitation and lecture hours per week.

Prerequisite: E. E. 305.

Required of Junior Electrical Engineers.

The work in this course covers the study of telephone receivers and transmitters, multiple switchboards; magneto and common battery systems, intercommunicating systems and automatic exchanges.

Electrical Engineering 401. Advanced Alternating Current Theory.

3 Credits.

Senior year. Three recitation and lecture hours per week.

Prerequisite: E. E. 306.

Required of Senior Electrical Engineers.

The work in this course covers the advanced theory of self and mutual inductance, capacity, single and polyphase systems, alternating current generator characteristics, and parallel operation of alternators.

Electrical Engineering 402. Advanced Alternating Current Theory

3 Credits.

Senior year. Three recitation and lecture hours per week.

Prerequisite: E. E. 401.

Required of Senior Electrical Engineers.

The work in this course covers the advanced theory of alternating current transformers, synchronous and induction motors, rotary converters and rectifiers.

Electrical Engineering 403. Illumination

3 Credits.

Senior year. Two hours recitation and three hours laboratory work per week.

Prerequisite: E. E. 306.

Elective for Senior Electrical Engineers.

The work in this course covers the principles of illumination, a study of the construction and characteristics of different types of electric lamps, solution of problems on interior lighting, and photometry.

Electrical Engineering 404. Seminar

2 Credits.

Senior year. Two hours recitation per week.

Senior year, 2 hours recitation per week.

Prerequisite: E. E. 306.

Required of Senior Electrical Engineers.

The work in this course covers the preparation and presentation of technical papers and a digest is made of current technical literature.

Electrical Engineering 405. Electric Railways.

2 Credits.

Senior year. Two hours recitation per week.

Prerequisite: E. E. 306.

Elective for Senior Electrical Engineers.

The work in this course consists of recitations and problem work devoted to the study of modern electric traction covering construction, equipment and operation of the different types of roads.

Electrical Engineering 406. Electric Central Stations.

3 Credits.

Senior year. Three hours recitation or calculation per week.

Prerequisite: E. E. 306.

Elective for Senior Electrical Engineers.

The work in this course covers the design and economic features governing the operation and management of central stations.

Electrical Engineering 407. Distribution & High Tension Transmission

3 Credits.

Senior year. Three hours recitation per week.

Prerequisite: E. E. 306.

Elective for Senior Electrical Engineers.

The work in this course covers the principles involved in the design of distributing systems for

buildings and municipalities, line calculations, and design of high tension transmission lines.

Electrical Engineering 408. Wireless Telegraphy.
2 Credits.

Senior year. Two hours recitation per week.
Prerequisite: E. E. 401.
Elective for Senior Electrical Engineers.

The work in this course covers the theory of wireless telegraphy and a study of modern equipment for the dispatch and receipt of wireless messages.

Electrical Engineering 410. Meter Testing & Standardizing
3 Credits.

Senior year. Two hours recitation and 3 hours laboratory per week.
Prerequisite: E. E. 306.
Elective for Senior Electrical Engineers.

The work in this course constitutes a study of the construction of the different types of electrical meters, checking and calibrating electrical instruments, watthour-meter testing, and precise measurements.

Electrical Engineering 412. Inspection Trip
1 Credit.

Senior year, one week continuous inspection trip (8 hours per day).
Prerequisite: none.
Elective for Senior Electrical Engineers.

The students accompanied by a member of the faculty make visits to various manufacturing establishments and power plants, studying the apparatus and the systems of management used at the points visited.

Electrical Engineering 414. Thesis.
4 Credits.

Senior year. Twelve hours library or laboratory work per week.
Prerequisite: E. E. 401.
Elective for Senior Electrical Engineers.

The work in this course consists of the solution of a problem involving original research, either by

actual experiment or by the study of existing data, selected by the student in conference with the head of the department of Electrical Engineering.

Electrical Laboratory 351, Direct Current Machines.
1 Credit.

Junior year. Three hours laboratory work per week.

Prerequisite: Taken with E. E. 301.

Required of Civil Engineers, and elective for Metallurgical and Mining Engineers.

The work in this course consists of the determination of efficiencies and characteristic curves of direct current motors and generators.

Electrical Laboratory 352. Alternating Current Machines.
1 Credit.

Junior year. Three hours laboratory work per week.

Prerequisite: Taken with E. E. 302.

Required of Civil Engineers, and elective for Metallurgical and Mining Engineers.

The work in this course consists of the determination of the characteristics of transformers, alternators, alternating current motors and rectifiers.

Electrical Laboratory 353. Electrical and Magnetic Measurements.
2 Credits.

Junior year. Three hours laboratory work and three hours report work per week.

Prerequisite: Taken with E. E. 303.

Required of Junior Electrical Engineers.

This is a course in precision measurements in electricity and magnetism.

Electrical Laboratory 354. Advanced Electrical and Magnetic Measurements.
2 Credits.

Junior year. Three hours laboratory work and three hours report work per week.

Prerequisite: Taken with E. E. 304.

Required of Junior Electrical Engineers.

This is a continuation of the work in Electrical Laboratory 353.

Electrical Laboratory 353. Direct Current Laboratory.

2 Credits.

Junior year. Three hours laboratory and three hours report work per week.

Prerequisite: Taken with E. E. 305.

Required of Junior Electrical Engineers.

The work in this course consists of the determination of the efficiencies and characteristics of direct current generators, and the parallel operation of direct current generators.

Electrical Laboratory 356. Advanced Direct Current Laboratory.

2 Credits.

Junior year. Three hours laboratory and three hours report work per week.

Prerequisite: Taken with E. E. 306.

Required of Junior Electrical Engineers.

The work in this course consists of the determination of the efficiencies and operation characteristics of direct current motors and a study of the commercial tests made at the factory.

Electrical Laboratory 451. Alternating Current Laboratory.

4 Credits.

Senior year. Six hours laboratory and six hours report work per week.

Prerequisite: Taken with E. E. 401.

Required of Senior Electrical Engineers.

The work in this course consists of the determination of resistance, reactance, impedance, etc. of both series and parallel circuits; measurement of power and alternating current circuits; regulation and efficiencies of alternators and transformers.

Electrical Laboratory 452. Advanced Alternating Current Laboratory

2 Credits.

Senior Year. Three hours laboratory and three hours report work per week.

Prerequisite: Taken with E. E. 402.

Required of Senior Electrical Engineers.

The work in this course consists of a study of parallel operation of alternators, mesh and star connections and transformers, efficiency and regulation tests of induction and synchronous motors, and rotary converters.

Electrical Engineering 376. Direct Current Design
1 Credit

Junior Year. Three hours calculations per week.

Prerequisite: E. E. 305.

Required of Junior Electrical Engineers.

In this course, the various materials used in the construction of electrical machinery are considered from mechanical and electrical standpoints. A complete set of electrical calculations are made for one direct current generator.

Electrical Engineering 475. Alternating Current Design
2 Credits.

Senior Year. Six hours calculations and draughting per week.

Prerequisites: E. E. 306 and E. E. 376.

Elective for Senior Electrical Engineers.

This course is divided into two separate parts. A complete set of calculations and a cross section drawing is made for both a transformer and an induction motor.

MECHANICAL ENGINEERING

Mechanical Engineering 301. Thermodynamics
3 Credits.

Junior Year. Three hours recitations or lectures per week.

Prerequisites: Physics 202 and Math. 202.

Required of Junior Electrical Engineers.

The work in this course consists of a study of the principles of thermodynamics as applied to the steam engine and other heat motors. Also the applications of the laws of heat and of the transformation of heat into work for perfect gases, steam, and combustion mixtures in internal combustion engines.

Mechanical Engineering 302. Steam Boilers

2 Credits.

Junior Year. Two hours recitations or lectures per week.

Prerequisite: Mech. E. 301.

Required of Junior Electrical Engineers.

The work in this course consists of a descriptive study of the different types of steam boilers, grates, superheaters, etc., and the methods of rating and testing steam boilers.

Mechanical Engineering 401. Steam Engines and Turbines

3 Credits.

Senior Year. Two hours recitations or lectures per week and three laboratory hours per week.

Prerequisite: Mech. E. 301.

Required of Senior Electrical Engineers.

The work in this course consists of the theoretical and practical operation of steam engines and turbines. Stress is laid upon efficiencies and the effects of superheat and vacuum.

GEOLOGY AND MINERALOGY

Professor Connolly. Professor O'Harra.

Library, Laboratory, and Field Facilities

A well equipped departmental library is placed convenient to the lecture and laboratory rooms, and students are required to make intelligent use of the literature contained therein.

The laboratory equipment and museum collections, elsewhere described, furnish indispensable material for practical work of many kinds.

Field facilities are unsurpassed. Unusual opportunity is offered for study in the field of the various geological horizons, including important and valuable economic deposits. Within a few miles of the school the student may observe upturned strata of nearly all geological ages. Twenty miles southwest of Rapid City is the Harney Peak granite area, with its lavish variety of mineral specimens. Surrounding this is a wonderful exposure of Algon-

kian metamorphic rocks cut in many places by auriferous quartz veins. The Cambrian, Carboniforous, Triassic, Jurassic, and Cretaceous are extensively developed. The famous White River Badlands of Tertiary age lie to the southeast of the hills and afford fossils which have made the region known wherever the science of paleontology is taught. In the northern part of the hills important igneous rocks, such as rhyolite, phonolite, andesite, and dacite, occur in the form of dikes, sheets, and laccoliths. Closely associated with these in slates, quartzites, and limestones, gold ores of the greatest importance are found.

In the autumn short field excursions are made by the class to nearby points of interest, and occasionally a visit of several days is made to more distant localities. Thus the student, in addition to lecture and laboratory instruction, has the advantage of systematically directed field study and with the information thus gained, he should be able to undertake for himself the working out of practical field problems.

Geology 201 and 202. General Geology

4 Credits per Semester.

Sophomore Year. Three hours recitation, and three laboratory hours per week.

Prerequisites: Preparatory physics and chemistry.

Required of all Sophomores.

This course is arranged primarily as introductory to all work in geology and mineralogy. It extends throughout the Sophomore year, and embraces a comprehensive study of the fundamental principles of geology. The course includes brief but careful study of dynamical, stratigraphical, structural, chemical, and historical geology, and is conducted by means of lectures, textbooks, and laboratory work, and frequent excursions to points of particular interest. Under dynamic geology the atmospheric, aqueous, igneous, and organic agencies are discussed with reference to their bearing on the present and past condition of the earth's surface.

Stratigraphical and structural geology consider the conditions of deposition of sediments and of the

disturbance of rock masses. A portion of the time allotted to these subjects is devoted to the study of such minerals and rocks as enter largely into the structure of the earth's surface; also to the methods of geological surveying, including mapping, section making, and special problems. Chemical geology includes the study of the general relation which chemistry bears to geological phenomena, such as the formation, metamorphism, and degeneration of rocks, and the origin and alterations of the various kinds of mineral deposits. Under historical geology the physical history of the earth is discussed, the classification and distribution of sedimentary rocks studied, and the methods of correlation explained. The course aims to equip the student with useful information concerning the phenomena and history of the earth, so that he may know the methods used in geological research, and will better understand how to interpret facts gained in the study of economic deposits.

Text-books: Pirsson's Text-book of Physical Geology. Miller's Introduction to Historical Geology. Tarr's Tables for the Determination of the Common Minerals and Rocks.

Mineralogy 301 and 302

4 Credits per Semester.

Junior Year. Two hours lecture and six laboratory hours per week.

Prerequisites: Geology 201 and 202, Chemistry 101 and 102.

Required of students in the Mining and Metallurgical Engineering Courses.

Texts: Dana-Ford Manual of Mineralogy; Lewis' Determinative Mineralogy.

This course runs throughout the year. Eight weeks of the first semester are given to the study of symmetry, forms, and classification of crystals. In the laboratory the student becomes familiar with the various types of crystals through the study of models, and later is required to identify the forms of one hundred mineral crystals.

The remainder of the semester and most of the second semester are devoted to general and determinative mineralogy. During the lecture hours the composition, forms, properties, occurence, origin, associations, and uses of about two hundred mineral species are studied, special attention being given to ore and common rock forming minerals. In the laboratory the methods of blowpipe and other chemical analysis for the determination of minerals are reviewed, after which the student is required to identify several hundred unlabeled specimens of minerals by means of physical properties and chemical tests. Although the student becomes familiar with the methods and technique of blowpipe analysis, he is encouraged to identify minerals by physical properties alone where that is possible, in order to develop such information as may be needed for the quick and accurate determination of minerals in the field.

During the last few weeks of the second semester a short practical study of the more common rocks is taken up, based upon Professor Pirsson's admirable text.

Geology 401 and 402. Economic Geology
4 Credits per Semester.

Senior Year. Four hours lectures per week.

Prerequisites: Geology 201 and 202, Mineralogy 301 and 302.

Required of Senior Mining Engineering students.

This course runs throughout the year, and includes the study of the origin, modes of occurrence, and uses of economic mineral products except mineral fuels. About one half of the first semester is given to the study of non-metallic products, salines, building stones, clays, cement materials, fertilizers, abrasives and gems. The rest of the course is devoted to the study of metallic products, gold, silver, copper, iron, lead, zinc, platinum, mercury, nickel. In this much attention is given to the study of the principles of ore deposition and to the historical development of the theories connected therewith. Careful attention is given to

the chief types of deposits and particularly to localities noted for their wealth of output.

Maps, specimens, and original papers are freely used. The necessity of individual examination by the student of the best up-to-date literature is insisted upon, and a reasonable ability to properly use such literature is required. Much attention is given to the study of the many economic interests of the Black Hills region, and observation of the deposits in the field is encouraged.

During the latter part of the course the student is introduced to the science of Mineragraphy, or the application of the metallographic microscope to the study of ore minerals in polished section. This recently developed science has assumed an important place in the study of ore deposits, and is an essential part of the equipment of the well trained mining engineer and mining geologist. Students make a number of polished sections themselves, and learn the methods of identification of the opaque minerals under the reflecting microscope, and the interpretation of the structures observed.

Reference Texts: Beck-Weeds Nature of Ore Deposits; Ries' Economic Geology; Lindgren's Mineral Deposits; Kemp's Ore Deposits of the United States and Canada; Beyschlag, Vogt, and Krusch's Ore Deposits (translation by Truscott); Emmons' Principles of Economic Geology; Davy and Farnham's Microscopical Determination of the Ore Minerals.

Geology 501. Optical Mineralogy and Petrography
5 Credits.

Three lecture hours and six laboratory hours per week.

Prerequisites: Mineralogy 201 and 202.

Elective.

Optical Mineralogy: This course is mainly introductory to the study of Petrography. It aims to enable the student to recognize the common minerals by means of the microscope. A study of the principles of light, such as reflection, refraction, and interference is offered, and the different media and their wave fronts, optical signs and in-

dicatrices receive special attention. This is succeeded by an application of these laws to the movement of light in different crystals, and the use of the petrographic microscope in the identification of minerals in thin sections. For laboratory work excellent Leitz and Zeiss microscopes are available. The fairly extensive collection of thin sections includes a special set of 120 oriented mineral sections manufactured by Krantz.

Petrography: This course is intended for mining students who need some training in rock determination, but who have opportunity to devote only a short time to the subject. It embraces the study of rocks, both in hand specimen and under the microscope. The lectures are devoted to a general discussion of the principles of rock classification, special attention being given to the systems of Kirkel and Rosenbusch modified as in use in America. This is followed by a brief summary of the Quantitative System of classification. The origin, distribution, mode of occurence and relations of rock masses are included. The principles of regional and contact metamorphism, and a classification of metamorphic rocks follow. For the laboratory work a Krantz collection of 350 rocks and thin sections is available. In addition there is a fairly complete collection of Black Hills rocks, most of which are thin sectioned. There is also a set of unlabeled rocks, with accompanying thin sections, which are used for study and description by the student.

The Black Hills offer an exceedingly interesting field for the petrographer on account of the great variety of rock types within their small area. When possible field excursions will be taken to points of interest, especially to the igneous and metamorphic areas.

Reference Books: Manual of Petrographic Methods, Johannsen. Determination of Rock Forming Minerals, Johannsen. Rock Minerals, Iddings. Igneous Rocks, Iddings. Igneous Rocks and Their Origin, Daly. The Natural History of Igneous Rocks, Harker. Petrology for Students, Harker. Lecture Notes.

Geology 502. Economic Geology of the Mineral Fuels

3 Credits.

Three lecture hours per week. Occasional field work.

Prerequisites: Geology 201 and 202.

Elective.

This course offers a detailed study of coal, petroleum, and natural gas; their origin, mode of occurrence, and distribution. In that part of the course devoted to petroleum and natural gas, the field methods of the petroleum geologists will be studied, and some practice in areal mapping and structural interpretation will be offered.

Reference Books: Coal; Ries, Economic Geology; Stevenson, Formation of Coal Beds; Reports of the National and State geological surveys. Petroleum and Gas; Emmons, Geology of Petroleum; Hagar, Practical Oil Geology; Cox, Dake, and Muilenberg, Field Methods in Petroleum Geology; Reports of the National and State geological surveys.

MATHEMATICS

Professor McLaury.

The engineer, from the very nature of his work, must of necessity meet many difficult problems. His success will depend on his ability to solve them. As it is impossible to tell in advance just what experience a given student will meet, that course is best which results in mental power. It is not a question of what the student has done, but what he can do. Has he a comprehensive grasp of the subject; has he thoroughly mastered the principles; can he apply these principles to kindred subjects?

The aim of this department will be to give the student a thorough knowledge of the principles of mathematics so as to enable him to apply them readily to the solution of practical problems. Original work is encouraged, and an effort is made to cultivate the habit of exact, logical reasoning, and to stimulate independent thought. Both rapidity

and accuracy are expected in all mathematical work. The great importance of mathematics as the basis of a scientific education justifies the requirement of all elementary courses, as a prerequisite to the engineering courses.

In the following courses, particular pains will be taken to explain all the more difficult algebraic processes as they occur. Several subjects in higher algebra will be discussed, each at the point where it is required for immediate application. Students who have not studied algebra for a year or more, should make a careful review before entering school, for a thorough knowledge of the elements of algebra is essential to the successful completion of all subsequent courses. All students who have had less than two years of algebra should continue algebra with their Freshman work. To this end there is arrangement by which one may take algebra two lecture periods per week during the first and second semesters.

Mathematics 101. Trigonometry

5 Credits.

Freshman Year, First Semester. Five lecture hours per week.

Required of all Freshmen.

Text Book: Phillips & Strong's Trigonometry.

Plane, analytical and spherical. Considerable attention is paid to the consistent and scientific development of the fundamental conventions and definitions, and to the derivation and transformation of trigonometric expressions. Many practical problems are solved.

Mathematics 102. Analytic Geometry

5 Credits.

Freshman Year, Second Semester. Five lecture hours per week.

Prerequisite: Math. 101.

Required of all Freshmen.

Text Book: Nichol's Analytic Geometry.

This course includes the following subjects: Loci, straight lines, transformation of co-ordinates; circles; conic sections; the general equation of the second degree and higher plane curves.

The theory will be developed by lectures.

Mathematics 201. Differential Calculus
4 Credits.

Sophomore Year, First Semester. Four lecture hours per week.

Prerequisite: Math. 102.

Required of all Sophomores.

Text Book: Granville, Differential and Integral Calculus.

The text book work is supplemented by lectures. This course will include a short course in solid analytic geometry, based on Nichol's Analytic Geometry.

Mathematics 202. Differential and Integral Calculus
4 Credits.

Sophomore Year, Second Semester. Four lecture hours per week.

Prerequisite: Math. 201.

Required of all Sophomore.

This course is a continuation of the last course and will include the most of the work in Granville's Calculus.

METALLURGY

Professor Traphagen.

Metallurgical subjects are taught by lecture courses with frequent reference to standard works on the subject, and to the current literature.

The lectures are supplemented, as far as possible, by laboratory work and experiments, and by excursions to neighboring metallurgical works. The school is favorably situated in being contiguous to an active gold mining district, the Black Hills, affording excellent opportunity to study the practical side of metallurgy, particularly that of gold, on a large scale and at close range. The stamp mills and cyanide plants of Lawrence county are easily reached by rail in two hours' time.

A well equipped metallurgical laboratory is available for use, and it is desirable that the student should be thoroughly trained in the basic scientific principles of metallurgy. With actual

metallurgical operations, on a large scale, the student becomes familiar to such an extent as is desirable during his school years, by visits to the working plants of the district.

In the laboratory he becomes acquainted with the use of pyrometers, calorimeters, microscopes for the examination of metals and furnace products and other scientific metallurgical apparatus. He conducts experiments in the refining and heat treatment of steel, electric deposition of metals, formation of slags, refining of metals, cyanide process and amalgamation, etc. He becomes experienced to some extent with actual working of a furnace, stamp mill, concentrating tables and cyanide plant with which the laboratory is provided.

The department is equipped with a card index of metallurgical literature, which covers all of the subjects of interest, and is at the service of students.

Metallurgy 301. General Metallurgy

3 Credits.

Junior Year, First Semester. Three lecture hours per week.

Required of Junior Mining and Metallurgy students.

Text: Hofman, General Metallurgy.

This course consists of lectures on the physical properties of metals; on alloys, their types, nature and properties; fuels; combustion; refractory materials, thermal measurements; discussions of metallurgical principles, slags and furnace products and their nature; types of furnaces and furnace construction; the means of supplying and heating blasts; thermo-chemistry, including a discussion of chemistry at high temperatures; typical metallurgical processes and the general economic considerations of metallurgy, such as buying and selling ores and metallurgical products. Students are required to do outside reading from references given in the class room and hand in for examination papers on topics assigned.

Metallurgy 302. Assaying

4 Credits.

Junior Year, Second Semester. One lecture hour and nine laboratory hours per week.

Required of students in Mining and Metallurgy.

Text Book: Traphagen; Lecture Notes.

This course is taught by lectures and by laboratory work, based on the lectures. Elementary chemistry, qualitative and quantitative analysis are prerequisites, being necessary for a thorough understanding of the work.

The work of the laboratory includes assaying of reagents, the testing of ores to discover their nature; the study of oxidizing and reducing reactions occurring in assaying; the study of typical assay slags; the assaying of pure gold and silver ores by crucible and scorification methods; the special assaying of copper and zinc ores containing gold and silver; the assaying of arsenical and antimonial ores for gold and silver; the study of cupellation and the factors which influence its results; the assaying of impure ores by the roasting, the nitre, iron nail and excess litharge methods; the assaying of telluride ores, lead bullion, cyanide solutions and precipitates for gold and silver; the assaying of gold and silver bullion; the assaying of ores and alloys for platinum, iridium, etc.; the assaying of lead and tin ores, and the assaying of furnace products.

Metallurgy 304. Iron and Steel

3 Credits.

Junior Year, for Metallurgical Students, Senior Year for Mining Students, Second Semester: Three lecture hours per week. Lectures notes.

Text: Stoughton, Metallurgy of Iron and Steel.

This course consists of lectures on iron alloys, their classification, structure, properties, metallography, taking up more particularly iron and steel. The hardening and tempering of steel receive special attention. The metallurgy of cast iron, wrought iron and steel is discussed in principle, but not in great detail. Especial attention is paid to the principles and chemistry of the iron blast furnace

to the Acid Bessemer process, and to the Acid and Basic Open Hearth processes. Statistics of the iron and steel industry are given. The student is required to do considerable outside reading.

Metallurgy 401. Gold and Silver

2 Credits.

Senior Year, Firest Semester. Two lecture hours per week. Lecture notes.

Required of students in Mining and Metallurgy.

Reference Works: Julian & Smart, Cyaniding of Gold and Silver Ores; Henry Louis, Handbook of Gold Mining; T. K. Rose, Metallurgy of Gold; Del Mar, Stamp Milling; McFarren, Cyanide Practice; Clennel, The Cyanide Handbook; Thomson, Stamp Milling and Cyaniding.

This course consists of lectures on the metallurgy of gold-silver, taking up first, modern stamp mill practice, discussing in detail mortar boxes, stamps, screens, general battery construction, and the influence of weight of stamp, screen mesh, mortar box dimensions, amount of water, on results obtained. Inside and outside amalgamation is studied in detail; the general mill arrangements; clean up; the influences of other processes following amalgamation; modern fine grinding in tube mills and other apparatus. This is followed by a discussion of the cyanide process for gold and silver ores; wet and dry crushing; crushing in cyanide solution; the separation of sands from slimes; the treatment of sands by percolation; the treatment of slimes by decantation, filter pressing and vacuum filtration; the precipitation of gold and silver by the various methods in use, methods of cleaning up, and the smelting of cyanide precipitates. The general chemistry of cyanidation is discussed, also the chloridizing process for silver ores, etc.

Metallurgy 403. Copper

3 Credits.

Senior Year, First Semester. Three lecture hours per week.

Required of students in Mining and Metallurgy.

Reference Works: Peters, Practice of Copper Smelting; Schnabel, Handbook of Metallurgy; Peters, Principles of Copper Smelting.

This course consists of lectures on the modern metallurgy of copper. It includes the types of copper ores and the methods suitable for the treatment of the different types. The principles of the blast furnace, and reverberatory processes for copper are discussed in detail, as they bring out clearly the chemistry of copper. Matte smelting for copper ores is studied, both pyrite smelting and ordinary matte smelting receiving careful attention; also the roasting of copper ores and calculation of charges. This is followed by the discussion of the Bessemerizing of copper mattes and the electrolytic refining of blister copper. In addition to this the wet method for copper ores are described.

Metallurgy 404. Non-ferrous Metals
5 Credits.

Senior Year, Second Semester. Five lecture hours per week.

This course takes up the consideration of metals not covered in other courses. Lead, zinc, tin, mercury, nickel and various other metals are here studied and special emphasis is placed on the principles underlying practice and the handling of complex ore mixtures.

Metallurgy 405. Pyrometry and Special Problems
2 Credits.

Senior Year, First Semester. Six laboratory hours per week.

Laboratory practice in pyrometry; calibration of the thermocouple with the use of potentiometer; the roasting of ores, noting the formation of sulphate, etc.; the desilveration of base bullion by the Parkes process. Special problems according to the requirements of individual students.

Metallurgy 406. Electro Metallurgy
2 Credits.

Senior Year, Second Semester. Two lecture hours per week.

Electrolytic processes applied to recovery of metals and refining of products. Aqueous and fused electrolytes. Electro thermic process, including a study of furnaces and the production and refining of metals.

Metallurgy 408. Cyanide Testing
2 Credits.

Senior Year, Second Semester. Six laboratory hours per week.

Testing of ores for the cyanide process. The student will have thorough training in the testing of ores for the purpose of ascertaining the best methods of treatment of a given ore. The data obtained will be used in the work in the drafting room in the course in Metallurgical Design.

Metallurgical Engineer

This advanced degree will be given to students who satisfactorily complete the fifth year of the metallurgical course which provides for a number of electives in addition to the advanced subjects in metallurgy. A minimum of fifteen lecture hours per week, or the equivalent, will be required. Provision is made for granting the degree also to graduates of the school, who have not completed the Fifth Year but who have shown capability and accomplishment in the active practice of their profession. The general requirements are given elsewhere, and the detailed arrangements are in charge of the Thesis Committee.

MINING

Professor Bochert.

The instruction in Mining is given by lecture courses, illustrated by lantern views, photographs and drawings; by frequent reference to standard works and current literature; by experimental work on various types of ores, carried on in the mining laboratory, and by excursions to nearby mines and mills for the purpose of observing and noting actual conditions of practice.

The department enjoys to an unusual degree, those advantages which naturally accrue from the school's location. Being contiguous to a world famous mineral region, the nearness of large producing mines means much, while the wholesome mining atmosphere in which the student lives, furnishes a

never failing supply of food for enthusiasm and interest.

The mining and metallurgical laboratory of the school, which has proven a most valuable adjunct to the work of instruction, is fully equipped with modern appliances of approved design. The operations attendant upon the preliminary treatment of various types of ore are here carried out by the students on a scale approaching commercial practice.

Special field work in mining is held each year in April. A suitable mining locality having been selected, students under the direction of instructors devote one week to the study of practical mining, both above and below ground, systematic note taking and careful sketching of all principal features being a requirement. Attendance upon this work is obligatory with all members of the Senior class.

The uniform courtesy and good will shown by the management of mining enterprises throughout the region to instructors and students indicates a wholesome regard for the efforts of the department and constitutes one of its most valuable assets.

The following courses are offered by the department:

Mining 301. Boring, Breaking Ground and Explosives

3 Credits.

Junior Year, First Semester. Three lecture hours per week.

Required of students in Mining, Metallurgy and Civil Engineering.

Boring: The use of the earth auger, drive pipe, etc., in the boring of holes for wells and for prospecting purposes; the boring of deep holes by the churn drill and drop tool, also the diamond and other rotary drills; the survey of bore holes; the cost of boring.

Breaking Ground: The excavation of earth and rock in general; hand tools; mechanical earth excavators; rock drills and their use; channelers; coal cutters, steam shovel; dredges, etc; estimates and costs.

Explosives: Black powder, nitro-glycerine, gun cotton and their derivatives; methods of testing the force of explosion and heat development; pointing and charging of holes; methods of firing; cost of blasting operations.

Mining 302. Tunneling and Shaft Sinking

2 Credits.

Junior Year, Second Semester. Two lecture hours per week.

Required of students in Mining, Metallurgy and Civil Engineering.

Tunneling: The driving of mine tunnels and drifts through rocks and through soft or running ground; comparative cost, general discussion of the methods used in driving large tunnels for railroad and other purposes.

Shaft Sinking: The sinking of shafts for mining purposes through soil, rock, quicksand and other water-bearing strata, by approved methods; costs of same.

Mining 303-304. Ore Dressing

4 Credits per Semester.

Junior Year, First and Second Semesters: Three lecture hours and three laboratory hours per week.

Required of students in Mining and Metallurgy.

The principles of ore crushing with description of the various types of crushing machinery; screens and the principles of screen sizing; stamp milling and amalgamation; the theory and practical application of the dressing of ores by water currents, including description of the principal forms of classifiers; jigs and the laws of jigging; concentrating tables; slime treatment and the machinery for its accomplishment; magnetic concentration; concentration by oil; dry concentration; general discussion of the continental and English systems of ore dressing and their American modifications; the description and study of typical ore dressing plants.

Mining 401. Drainage and Transportation

2 Credits.

Senior Year, First Semester. Two lecture hours per week.

Required of students in Mining and Metallurgy.

Drainage: Sources of mine water; dams and drainage levels; hoisting of water; Cornish and direct acting pumps; centrifugal pumps; use of compressed air and electricity in pumping operations; special examples and costs.

Transportation: Underground and surface haulage; vehicles and motive power; self-acting and engine planes; tail rope and endless rope systems of haulage; electric and pneumatic haulage; surface tramways and aerial ropeways.

Mining 402. Compressed Air

2 Credits.

Senior Year, Second Semester. Two lecture hours per week.

Required of students in Mining and Metallurgy.

The modern air compressor with accessories and the laws under which it operates; conveyance of compressed air in pipes; effect of altitude; air compression by the direct action of falling water; calculations; costs.

Mining 403. Exploitation

3 Credits.

Senior Year, First Semester: Three lecture hours per week.

Required of students in Mining.

Exploitation: The extraction of mineral by open works, by wells and bore holes; the underground working of veins, bedded deposits and masses by methods best suited to each; conditions affecting the choice of methods; cost of ore extraction.

Supporting Excavations: The use of wood, metal and masonry in the lining of shafts and other excavations, their relative cost, strength and durability; the timbering of stopes, stations and other working places underground; the preservation of timber.

Hoisting: Hoisting engines, their construction and chief features; methods of equalizing the load moment on the engine; ropes, cages, skips and safety appliances; gallows frames, pneumatic hoisting; costs.

Mining 404. Ventilation, Lighting and Placer Mining

3 Credits.

Senior Year, Second Semester: Three lecture hours per week.

Required of students in Mining.

Ventilation: Natural and induced ventilation; furnaces and fans; friction of air in mines; control of air currents; efficiency of ventilating appartus.

Lighting: Open lights, safety lamps, the electric and other lights used in underground illumination.

Placer Mining: Sluices, riffles, pipe lines, nozzles and hydraulic elevators, their construction and use; river dredging, costs and results.

Mining 405-406. Design of Mining Plant

Senior Year, First and Second Semesters. Six laboratory hours per week.

The student is given certain data relative to a hypothetical mine, such as maximum depth of hoist, capacity of hoisting, etc., from which he caculates the power needed, selects the type and size of hoisting engine, makes calculations as to the size of reel for flat rope, and drums of different forms, such as to give the best results in the equalization of moment on the engine. He then calculates and designs the gallows frame and shaft house, also other features such as ore bin, mine cage, car or skip.

Mining. Mine Examination.

Second semester. Two hours per week.

Principles underlying Mine Sampling. Implements used and general methods of sampling. Precautions necessary in the handling and preparation of samples. Estimation of "Ore in Sight." Methods of calculating values, tonnage, and costs of production; Forms of Report.

Mining. Efficiency Engineering and Administration

First Semester. Three hours per week.

Business management as applied to mining, milling and metallurgical plants. General methods of business, organization of staff, relations between workers and management, standardizing operations and working conditions, buying and selling ores, purchasing supplies and general store-room methods.

Accounting: Organization of corporations and stock companies with particular reference to mining and metallurgical companies, discussion of the general principles of book-keeping and accounting; classification of costs, and cost finding methods.

Mining. Safety Engineering and Hygiene

Second Semester. Three hours per week.

Accidents, their causes and prevention, sanitation and health conditions in and about mines, mills and metallurgical plants. Practical instruction will be given in First Aid to the Injured and Mine Rescue Work. Mine fires and explosions are discussed as to their origin, methods of fighting and precautions necessary for their prevention.

Engineer of Mines

This advanced degree will be given to students who satisfactorily complete the fifth year of the mining course which provides for a number of electives in addition to the advanced subjects in mining. A minimum of fifteen lecture hours per week or the equivalent, will be required Provision is made for granting the degree also to graduates of the school who have not completed the fifth year but who have shown capability and accomplishment in the acitve practice of their profession. The general requirements are given elsewhere, and the detailed arrangements are in charge of the Thesis Committee.

PHYSICS

Professor Watson

The Engineer, from the very nature of his profession, must deal with the material things

about him and hence a knowledge of the laws governing the behavior of material things under certain definite conditions is of prime importance. The courses in Physics are intended to give a working knowledge of the fundamental principles involved in the following subjects: mechanics, heat, sound, light and electricity, thus giving the student a foundation for a more detailed study in any of these subjects when he meets them in later work.

Physics 1

First Semester: Four lecture or recitation hours and six laboratory hours per week.

Prerequisites: Algebra through quadratics and plane geometry.

Text Books: Millikan, Gale and Pyle, Ahrens, Harley and Burns.

This Course is given in connection with the two years preparatory work to enable those coming from a high school which offers only two or three years work, to complete their entrance requirements. Any student who does not present Physics for entrance will be required to complete this course before entering the engineering courses. The work deals with the elementary principles of the mechanics of solids and fluids, and heat. The purpose of the laboratory work is to teach the student to apply the principles discussed in recitation, observe results and put them into the form of a report.

Physics 2

Second Semester: Four lecture or recitation hours and six laboratory hours per week.

This course is a continuation of Physics 1 and includes work in Magnetism, Electricity, Light and Sound.

Physics 201. General College Physics

5 Credits.

Required of all engineering students.

Sophomore Year, First Semester: Four lecture or recitation periods and one three-hour laboratory period per week.

Prerequisites: Mathematics 101 and 102.

Text Books: Anderson's Physics for Technical Students, Zeleny and Erikson, Manual of Physical Experiments.

This course covers the general properties of matter, mechanics, and heat. Special emphasis is placed on the practical phases of the subjects. The purpose of the laboratory work is to familiarize the student with the theory developed in the class work, and to teach him to interpret data and put results in the form of an engineering report.

Physics 202

5 Credits.

Sophomore Year, Second Semester: Four lecture or recitation hours and three laboratory hours per week.

General College Physics: This course is a continuation of Physics 3 and covers the work of Magnetism, Electricity, Light and Sound.

BIOLOGY

Associate Professor Ackerman

This department attempts to meet the needs of both the engineering and general student. A special endeavor is made to restrict and apply the subject matter of certain courses in such manner as to give the engineering student a maximum knowledge of the human problems which he shall meet, with a minimum expenditure of time. Courses 5a and 11 are framed to meet the needs of such students. The requirements of the non-engineering student are of a more varied nature, and a special endeavor shall be made to adopt the resources of the department to each individual case.

Biology 1-2. General Biology.

First and Second Semesters: Three lecture hours and three laboratory hours per week.

An introduction to the general facts and principles with regard to the structure, physiology, development, life history, relationships, and activities of plants and animals. Especial emphasis is given

to the biology of man and to civic and economic problems related to biology.

This course is designed especially for third year preparatory students.

Biology 3. Zoology

First Semester: Three lecture hours and three laboratory hours per week.

In this course a detailed study is made of a few representative forms of each of the main groups of animals. The main emphasis is given to structure and classification, but considerable attention is also given to development, life history, activities, economic questions, and to the main facts and approved hypotheses which are the basis of modern conceptions of animal life.

Biology 4. Botany

Second Semester: Three lecture hours and three laboratory hours per week.

A standard course in general botany for fourth year preparatory students.

Biology 101-102. Principles of Biology

4 Credits.

First and Second Semesters: Three lecture hours and three laboratory hours per week.

Text Book: Principles of Animal Biology, Shull.

An introductory course for the general student in which the basic theories and facts of biology are studied. Amongst the topics discussed are the Cell Theory, Embryology, Reproduction, Breeding Habits, Classification, Genetics, Ecology, Disease (Parasitism), Paleontology and Evolution. A course for students with college standing.

Biology 102a. Principles of Biology

Second Semester: Four lecture hours and three laboratory hours per week.

A course similar to Biology 101-102 but so contracted and applied as to meet the needs of engineering students more specifically. No prerequisite other than college standing.

Biology 201-202. College Botany

A standard course of college grade. Given by arrangement only. Prerequisite: Biology 101-102 or its equivalent.

Biology 203-204. College Zoology

Given by arrangement only. Prerequisite: Biology 101-102 or its equivalent.

Biology 401. Sanitation and Public Health

Senior Year, First Semester. Two lecture hours and three laboratory hours per week.

A course dealing with the cause, transmission, and control of infectious diseases, water supply, and sewage disposal.

Required of Senior Civil Engineering students.

Biology 103-104. Human Physiology

Given by arrangement only.

MODERN LANGUAGES

Associate Professor Droke

The importance of French from a scientific standpoint and the commercial value of Spanish, make a knowledge of one or both of these languages a decided asset to the engineer. As cultural subjects, they offer, through the study of grammar and composition, valuable aid in proficiency in English, and the reading of their literatures gives an insight into the life and thought of the people.

The aim of the department is to give students a sufficient command of the foreign language to enable them to write and speak it with a fair degree of correctness, and to understand it with reasonable ease. In the courses offered, special attention is given to training students to speak clearly, distinctly, accurately and with correct intonation.

French 1-2. Preparatory French

First and Second Semesters: Five lecture hours per week.

Texts: The New Chardenal; Meras and Roth, Petits Contes de France; Enault, Le Chien du Capitaine.

Beginners' Course. Grammar, drill in conversation, reading simple French.

French 3-4. Preparatory French

First and Second Semesters: Five lecture hours per week.

Texts such as: Labiche and Martin, Le Voyage de M. Perrichon; Dumas, La Tulipe noire; Loti, Pecheur d'Islande; Maupassant, Selections.

A continuation of French 1-2. More detailed work in grammar, elementary work in phonetics, reading of selected texts with conversation and themes based on these texts.

French 101-102. College French

3 Credits.

First and Second Semesters: Three lecture hours per week.

Texts: The New Chardenal; Meras and Roth, Petits Contes de France; Eanoult, Le Chien du Capitaine.

A beginners' course. Grammar, writing and speaking simple French, Reading elementary texts.

French 201-202. College French

3 Credits.

First and Second Semesters: Three lecture hours per week.

A continuation of French 101-102. Reading, with conversation and themes based on the texts, of such authors as Daudet, Maupassant, Loti, Hugo, France. Elementary work in phonetics.

Spanish 101-102. College Spanish

3 Credits.

First and Second Semesters: Three lecture hours per week.

Texts: Fuentes and Francois, A Trip to Latin America; Palacio Valdes, Jose.

An elementary course, similar to the one outlined under French 101-102.

Spanish 201-202. College Spanish

3 Credits.

First and Second Semesters: Three lecture hours per week.

Reading of texts from authors such as: Perez Galdos, Blasco Ibanez, Palacio Valdes, Juan Valera.

A continuation of Spanish 101-102, and similar in nature to French 201-202.

Special French

First and Second Semesters: Three lecture hours per week.

A special course in scientific French will be offered to students desiring such work.

Special Spanish

First and Second Semesters: Three lecture hours per week.

Texts: Ewart, Cuba y las Costumbres cubanas; Blasco Ibanez, Vistas sudamericanas; Luria, Correspondencia commercial.

Conversational and commercial course. Open to students having completed at least one year's work in Spanish. Designed for those especially interested in South America, Mexica and Cuba.

LIST OF STUDENTS, 1920-1921

Post-Graduate

Mallman Adolph.....Farmingdale, S. D.
Waldschmidt William A.....Lead, S. D.

Senior Class

Aikman, William .....Hermosa, S. D.
Enos, George.....Cottonwood, S. D.
Jacobs Morris.....Rapid City, S. D
Kalb, J. Lorenz.....Rochoster, Minn.
Lintz, Mark.....Hermosa, S. D.
Parsons Merle.....Rapid City, S. D.
Platt, Charles.....Rapid City, S. D.
Richardson, George.....Sioux Falls, S. D.
Rugg, Harold .....Lead S. D.
Schrader, Houston.....Rapid City, S. D.
Schuler, William.....Tinton, S. D.
Snyder, William.....Rapid City, S. D.
Wurtsbaugh C. Guy.....Irwin, Iowa

Junior Class

Christensen, Harold H.....Rapid City, S. D.
Emery, Dewey.....Sansarc, S. D.
Hammerquist Charles.....Rapid City, S. D.
Hayes, Joel P.....Rapid City, S. D.
Hett, Paul .....Lead, S. D.
Johnson, Arthur I.....Lead, S. D.
March Guy .....Hot Springs, S. D.
March, Raymond.....Hot Springs, S. D.
Markvart, Edwin.....Chicago, Ill.
McCracken, George.....Hot Springs, S. D.
Primrose, W. Shafter.....Lead, S. D.
Smith, Carrol.....Rapid City, S. D.
Snyder, John P.....Providence, Rhode Island

Sophomore Class

Best, Clare A .....Meadville, Pa.
Binckly, Basil.....Rapid City, S. D.
Bowen, Herman .....Lead, S. D.
Bryant, Stewart J.....Lead, S. D.
Calhoun, Paul .....Hot Springs, S. D.
Cha, Angelo.....Lead, S. D.

Deutsch, Raymond.....Rapid City, S. D.
Feigel, Mary.....Rapid City, S. D.
Germain, George.....Milbank, S. D.
Hedrick, Lucille.....Chamberlain, S. D.
Johnson, Everett.....Lead, S. D.
Jones, John.....Hot Springs, S. D.
Kirsch, Emil H. .....Chamberlain, S. D.
Manley, Clarence.....Georgetown, Ill.
Moffitt, Raymond.....Academy, S. D.
Monson, Harold.....Sioux Falls, S. D.
MacLaren, Albert S.....Cleveland, Ohio
Newcomer, Evelyn.....Rapid City, S. D.
Shedd, Bates .....Lead, S. D.
Spencer, Floyd.....Rapid City, S. D.
Stedronsky, Anton.....Lake Andes, S. D.
Stroup Charles.....Fort Pierre, S. D.
Teall, Homer.....Philip, S. D.
Tyrrell, Harvey.....Rapid City, S. D.
Wagner, Henry .....Deadwood, S. D.

Freshman Class

Anderson Ludlow.....Kooi, Wyo.
Anderson, Payton.....Rapid City, S. D.
Arneson, Harold.....Rapid City, S. D.
Babcock, Harold.....Belle Fourche, S. D.
Babington, Morgan .....Whitewood, S. D.
Babington, Willard.....Whitewood, S. D.
Bartlett, Frank..... .....Chamberlain, S. D.
Brown, Carroll.....Clark, S. D.
Brown, George D.....Rapid City, S. D.
Burnside, Carrol J..... .....Rapid City, S. D.
Carstens, Elmer.....Wessington, S. D.
Conklin, Lloyd.....Rapid City, S. D.
Coones, Samuel.....Philadelphia, Pa.
Dake, Earl..... .....Wessington, S. D.
Dale, William.....Rapid City, S. D.
Dexheimer, Philip.....Spencer, S. D.
Dickenson, Everett.....Underwood, S. D.
Donahue, Ray .....Clark, S. D.
Duncan, Houston.....Sheridan, Wyo.
Frank, Raymond.....York, Pa.
Fredin, Pierre.....Mission Hill, S. D.
Friday, Marshall.....Oshkosh, Wis.
Haas, Maurice.....Whitewood, S. D.

Harmegnies, Paul.....Oak Park, Ill.
Hawley, George.....Rapid City, S. D.
Hearn, Miles.....Rapid City, S. D.
Hill, Ward S.....Chamberlain, S. D.
Hodgin, Daniel.....Reliance, S. D.
Holt, Frank.....Trenton, N. J.
Hoover, Charles.....Philip, S. D.
Humble, Junior.....Lead, S. D.
Jepsen, Marvin.....Rapid City, S. D.
Johnson, Theodore.....Duluth, Minn.
Knox, Walter.....Clear Lake, S. D.
Larsen, Alfred.....Mitchell, S. D.
Long, Paul.....Belle Fourche, S. D.
Margulies, George.....Sioux Falls, S. D.
Marsh, Corbin.....Rapid City, S. D.
Martin, Clarence.....Presho, S. D.
Moore, William.....Tea, S. D.
Noble, Perry.....Watertown, S, D.
O'Harra, Wayne.....Rapid City, S. D.
O'Meara, Robert.....Lead, S. D.
Olson, Charles B.....Sioux Falls, S. D.
Olsen, Lester.....Rapid City, S. D.
Pfeiffer, Horace.....York, Pa.
Rounds, Dean.....Rapid City, S. D.
Rowan, Ray.....Artesian, S. D.
Russell, William.....Lake Andes, S. D.
Russell, George.....Lake Andes, S. D.
Saunders, W. L.....Niobrara, Neb.
Stevens, Edwin.....Richmond, Vt.
Surbeck, Homer.....Rapid City, S. D.
Turner, Ralph.....Hot Springs, S. D.
Utter, Kenneth.....St. Paul, Minn.
Walker, Leonard.....Midland, S. D.
Ward, Edward.....Bryant, S. D.
Westover, John.....Fairburn, S. D.
Westover, Maurice.....Fairburn, S. D.
Winter, Conrad.....Owatonna, Minn.
Witt, William.....Dallas, Texas
Woodruff, Jerrold.....Miller, S. D.
Wykoff, Ben.....Bedford, Ind.

Special Students

Chase, Newell.....Rapid City, S. D.
Crittenden, Ruth.....Rapid City, S. D.

Gantz, Frank.....Rapid City, S. D.
Gramberg, Emma.....Hermosa, S. D.
Hill, Louisa.....Rapid City, S. D.
Lund, Cecil.....Rapid City, S. D.
Newcomer, Delos.....apid City, S. D.
Perrigo, Harry.....Rapid City, S. D.
Shedd, Clarence.....Lead, S. D.
Stewart, Howard.....Lead, S. D.

Preparatory Students

Anderson, Warren.....Rapid City, S. D.
Archer, Warren .....Faith, S. D.
Behrens, George .....Outlook, Wash.
Barbour, Charles .....Belle Fourche, S. D.
Brodsky, Frank .....Owanka, S. D.
Conrad, Kenneth.....Faith, S. D.
Currie, Robert .....Everett, Wash.
Gadski, Richard .....Chicago, Ill.
Hoyt, Stanley .....South Norwalk, Conn.
Keown, Harold .....Rapid City, S. D.
Lorimor, Earl .....Caputa, S. D.
Marsh, Ralph .....Rapid City, S. D.
Maurer, John W. .....Newell, S. D.
Pearce, Milton .....Parsons, Kansas
Sexton, Clifford .....Ferguson, Iowa
Shevling, Charles .....Nisland, S. D.
Stukey, Carl .....Sioux Falls, S. D.
Thomson, Harold .....Presho, S. D.
Watkins, Harold .....Powell, S. D.
Wilson, Elmer .....Elmsprings, S. D.
Yang, Chung Ching .....Tainan, Formosa

ALUMNI

ALDER, ALFRED, JR., B. S. in Metallurgical Engineering, '13. Research Chemist, 46 West 12th Avenue, Denver, Colo.

ALGER, OTILLIE BEHRENS, B. S., Custer, S. D.

ANDERSON, AMIL ABNER, B. S. in Metallurgical Engineering, '13; Met. Eng. '17; E. M., '20. President Cotoba Mining Co.; Geologist Ogallala Oil Co., 1722 Stout Street, Denver, Colo.

ANDERSON, FRANK, B. S. in Mining Engineering, '17. Mining Engineer, Phelps Dodge Corp., Copper Queen Branch, Bisbee, Ariz.

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ANDERSON, O. ALLEN, B. S. in Mining Engineering, '04; E. M. '07. Superintendent, August Mining Co., Landusky, Montana.

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